DOCUMENT RESUME

ED 134 433 SE 021 719

TITLE Environmental Education Curriculum Guide - K-Grade 5. [Ah-Nei, The Special Classroom Environmental Education Study Area].
INSTITUTION Bureau of Land Management (Dept. of Interior), Billings, Mont.
PUB DATE Mar 75
NOTE 236p.; Not available in hard copy due to marginal legibility of original document

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS Biology; Curriculum; Earth Science; Ecology; *Elementary Education; *Elementary School Science; *Environment; *Environmental Education; Instructional Materials; *Outdoor Education; *Teaching Guides

ABSTRACT

This is a curriculum guide for environmental education designed for use in grades K-5. While the guide is designed to be used in a Montana environmental education study area, most activities can be used directly in other locations, others can be adapted. Included are: (1) a discussion of ecological terms, (2) a list of vocabulary words, (3) activities, and (4) suggestions for instruction. Most of the activities are detailed with background information for the teacher. The suggestions for instruction include a number of check lists and other practical suggestions for teachers. (RH)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED134435

AH-NEI

The Special Classroom

Environmental Education Study Area

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

SE 021 719

ENVIRONMENTAL EDUCATION

Curriculum Guide - K-Grade 5

developed by the Bureau of Land Management for use
at Ah-Nei - Environmental Education Study Area

"A picture is worth 1,000 words . . .

an EXPERIENCE is worth 1,000 pictures!"

The Bureau of Land Management encourages users to reproduce any part of this guide if it will aid them in meeting their educational objectives.

Some of the material on this guide is not the original idea of the BLM Environmental Education staff, but has been assimilated from a variety of sources. We acknowledge the contribution of these borrowed sources.

Printed - March, 1975

Welcome to "Ah-Nei"

The "Ah-Nei Environmental Education Study Area" embracing 4,000 acres of national resource lands was officially designated in June of 1973.

The initial use of the Study Area by students is scheduled for spring of 1975. More than five years of dedicated work by several people with a vision preceded this milestone.

It is my wish that use of this Study Area will add new dimensions to the progressive Environmental Education Program that Billings educators have been developing for over 10 years.

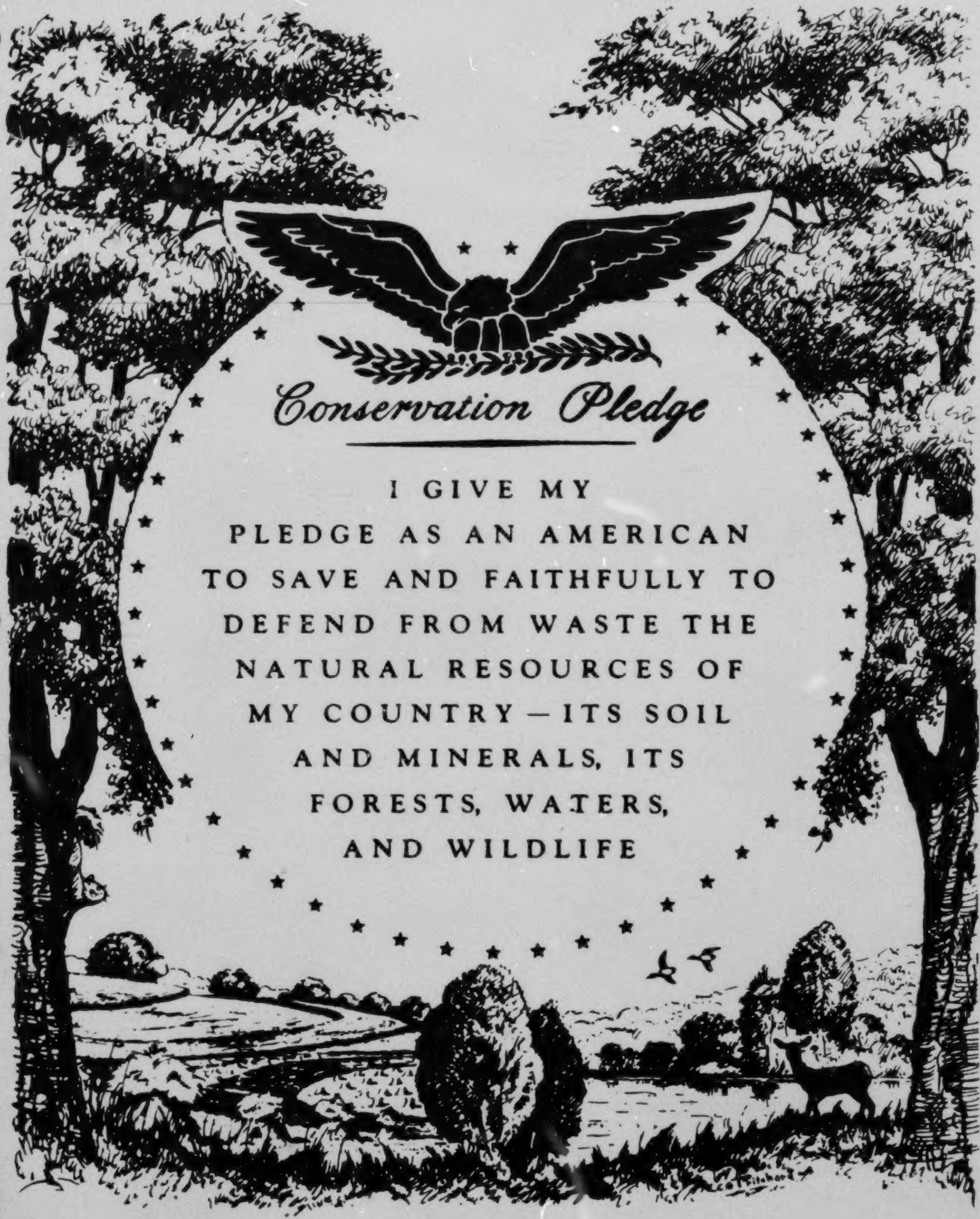
It is my belief that creation of a land-use conscience or ethic is essential for our society. Moreover, I believe that such a conscience or ethic will evolve sooner, and land use management, compliance, and enforcement will ultimately be simpler, if the youth of our society are provided comprehensive environmental education on the outdoor laboratories that can be provided on national resource lands.

As these youth mature, they will provide a cumulative influence, and add ecological perspective on how society views itself in the use of its land and resources.

I dedicate Ah-Nei Environmental Education Study Area to the youth of Billings.

Rex Cleary

C. Rex Cleary
Billings District Manager
Bureau of Land Management



Conservation Pledge

I GIVE MY
PLEDGE AS AN AMERICAN
TO SAVE AND FAITHFULLY TO
DEFEND FROM WASTE THE
NATURAL RESOURCES OF
MY COUNTRY—ITS SOIL
AND MINERALS, ITS
FORESTS, WATERS,
AND WILDLIFE

Purpose

It is the desire of the Billings District, Bureau of Land Management, to provide a valuable resource to the community by using National Resource Lands for development of education programs. Establishment of this Environmental Education site is a means of promoting a more environmentally aware citizenry in the Billings area. Thus equipped with such skills and knowledge concerning natural resources and environmental problems, they will be motivated to participate in decision-making processes as well as treat public lands and natural resources with respect.

Use of this study area will encourage "hands-on" learning in experiential situations and promote an increase in understanding human factors of trust, risk, acceptance, curiosity, and responsibility in their environment.

This is necessary to develop an appreciation of an area so that users feel protective and connected to their natural environment, while still realizing the important role that resources play in providing the basic needs of man and the necessary tradeoffs that result.

ACKNOWLEDGEMENT

Appreciation is extended to the following people for their never-failing support, educational contributions and enthusiastic cooperation in making this study area and guide a functioning reality.

Mr. John Bowers and staff - Division of Resources, Billings District

Dr. Will Clark - Eastern Montana College of Education

Mr. Rex Cleary - District Manager, Billings District

Mr. Charles Frank - Elementary Superintendent, Billings Schools

Mr. Ed Heiser - Environmental Education Coordinator, Billings Schools

Michigan State Department of Natural Resources - Michigan

Ms. Debbie Richau - Eastern Montana College of Education, Environmental Education Major

Mr. Ken Walker and staff - Yellowstone Resource Area, Billings District

In addition to those acknowledged above, this guide is dedicated to the "Sunshine" that warms and renews every day...

-Ginny Lewis
Environmental Education
Specialist-Billings District

Technical Credit for this guide:

Art --- Gene Edgar

Typists --- Charlotte Anderson
Marion Beierle
Patty Kruger
Nancy Peil

Printer --- Clyde Reeves, GSA

Table of Contents

Page

General Information. 1
List of Vocabulary Words 7
Maps 10
Study Areas Concept. 14
Suggested Use. 15
The Environmental Discovery Trail. 18
Natural Cycles Study Areas 33
Physical History Study Area. 135
Resources and Communities. 152
Mechanics. . . . .
    Leading Children in the Field. 188
    Safety, Conservation, Techniques 189
    After the Trip 190
    Use of Ah-Nei. 191
    Letter to Parents. .194
    Students Checklist. .195
    Principals Checklist 196
    Teachers Checklist .197
    Suggested Planning Schedule. 198
    References 199

Information

GENERAL INFORMATION

I. MULTIPLE USE OF OUR NATURAL RESOURCES

A. The Term Defined

"Multiple Use" is a planning concept for managing land.

The first goal of Multiple Use is to manage all the renewable resources of our lands so that they can be utilized without destroying any one of them. Good judgment is needed in the management of these resources. This means that in some areas land will be used for less than all resources because of the danger of destruction of one or more resources.

Multiple Use of our Natural Resources is an effort to coordinate and manage the use of the various resources in a harmonious manner, guarding against impairment of the productivity of the land.

B. The Importance of Multiple Use

Modern man has a tendency to lose sight of his dependence on the natural resources of our land. Today we depend on natural resources for all the raw materials of industry. Therefore, the wise use of these must be considered.

Maintenance of a vegetative cover on land protects water quality and quantity. To increase water yield, expert care must be given to the land cover.

Land managers need to be careful that land is not overgrazed by domestic animals or overbrowsed by wildlife. When the ground cover is poor, the water runoff is very rapid. This on-rush of water becomes a destroying force causing erosion, polluting streams, and creating damage. Proper ground cover keeps our streams pure and produces good fish habitat.

There is a growing awareness of the need to apply multiple use management more widely and more intensively. Multiple use management is designed to make public lands more useful to the public.

I. ROCKS AND MINERALS -- A Non-Renewable Resource

Everything that lives on land owes its life to soil and much of the soil about us was once rock. The rich soil was formed by small bits of rocks which were broken into soil by weather and growing plants. The small rock particles were mixed with dead plants and animals and formed rich, productive soil.

There are three main families or groups of rocks. Igneous rocks are very hard. They were formed by fire. These rocks were formed by extreme temperatures inside the earth. Lava from volcanoes is an example of this type of rock. Some of these rocks cooled and hardened slowly under the surface of the ground, while others cooled and hardened on top of the ground. Another family of rocks are Sedimentary. Sedimentary rocks are formed from sediment that settled on land or in water.

This type of rock usually has distinct layers. Many sedimentary rocks contain fossils. The third group of rocks is Metamorphic or "changed rocks." All kinds of rocks can be metamorphosed. Our earth moves and shifts. Earthquakes cause great changes. Often the rocks are pushed and squeezed in the earth's movements. Some have been pushed deep into the earth where pressure, heat, and gases have worked on them.

Rocks are made up of minerals. Minerals in rocks are separate substances, but together they make up different kinds of rocks. Some rocks consist almost entirely of one kind of mineral. Other rocks may contain scores of minerals in different amounts.

"Ah-Nei" varies in elevation from 3,500 to 4,000 feet. The study site includes parts of the Hell Creek formation, the youngest formation of the Cretaceous Age. (During the Cretaceous Age, dinosaurs became extinct and early mammals and flowering plants developed.) The Hell Creek formation consists of alternating beds of yellowish-grey sandstone, drab-colored clays, and grayish sandy shale. The area generally consists of rock slopes and canyons; sandstone beds form a series of flat benches and vertical cliffs. Limited amounts of water are produced in these sedimentary formations. Underground water and runoff are strong erosion factors in the area. Mineral deposits in the Hell Creek formation are negligible.

III. SOIL -- A Non-Renewable Resource

It takes a long time for soil to form. It is considered a basic resource because it is responsible for most of the things we use. More than this, soil is not unlike air and water because it, too, is necessary for all life on our planet.

Soil is formed in two general ways. The action of weather on rocks causes them to decompose or break down. Little by little the surface of the rock becomes softer and decays to become soil. Such soil is called residual soil. Soil surfaces may also be formed when wind, water, or glaciers carry soil from one place to another. Soil deposited by rivers and streams is called alluvium. Soil moved by glaciers i called till. Fine soil, blown about by the wind before it is deposited, is called loess. It is finer than sand, but coarser than clay.

Soil conservation means more than preventing erosion, checking the amount of water that runs off the surface of the ground, and putting a halt to the depletion of soil nutrients. We are no longer satisfied with merely stopping the depletion of our soil, but desire to improve the soil.

Soil is one of our most important resources. Wise use of soil and moisture on croplands, grasslands, and woodlands is the key to keeping our land productive.

Due to low vegetative cover on part of the "Ah-Nei" site, decomposition in the soil is minimal. In those areas the top soil is shallow and vulnerable to damaging erosion. The soils at "Ah-Nei" are mainly clay-like, breaking down from sedimentary rocks.

Better quality soil is found on the northern slopes of the rims. Here heavy concentrations of ponderosa pine and good vegetative cover contribute to ground litter and consequently, better soil conditions.

IV. WATER -- A Renewable Resource

A. What is a watershed? Simply stated, a watershed is an area of land from which a stream gets its supply of water. The watershed may cover only a few acres or it may be so large that it covers many square miles. A watershed is a combination of mountains, valleys, streams, forests, grass, farmlands, soil, and also cities, roads, people, and animals.

B. How the Watershed Operates

An effective watershed is one in which plant growth is present in abundance. The leaves and branches of trees, shrubs, grass, or other plants help break the force of falling rain. Together with the plant litter on the ground, they keep the rain from loosening the soil particles and causing the water to run off too quickly. All the while the litter and the organic materials are rotting and working into the ground, ever improving the spongy, porous nature of the soil.

Because there are many channels in the soil made by roots, burrowing animals, and insects, the water seeps to lower levels. The trees, brush, and all plant growth combine to stop the water from running off the surface too rapidly. Instead of running off, these plants help it to sink into the ground. All of this decaying litter and humus functions like a sponge. It soaks up the moisture. The plants use some of the water. Some of it evaporates, some of it finds its way to streams, and much of it soaks down through the soil, through rock strata, and is stored in the deep underground storage areas called aquifers.

C. The Importance of the Watershed

Water is the priceless resource on which all growing things depend. It takes efficiently managed watersheds to assure adequate supply.

D. The Management of Watersheds

Our government agencies manage our watersheds so as to assure us of water. Efforts are made to protect them from fire, excessive timber cutting, careless logging practices, overgrazing, and other damaging uses. The soil and its protective covering are maintained. There is planned use of the soil and plant cover on a watershed.

Most of the water at Ah-Nei is from underground springs coming from in sedimentary rock. The average rainfall is 13.3 inches per year.

There are several water-holding tanks in the area, fed by the springs.

V. FORESTS AND VEGETATION -- A Renewable Resource

A. The Importance of Vegetation

Forests and vegetation play a part in our watersheds. They help prevent landslides, snow slides, and erosion. Large areas of the forests are used for livestock grazing. Wildlife find their homes in the forests. There is use of the forests for various forms of recreation.

The aesthetic beauty, the atmosphere of peace, and relaxation are of great value.

B. Southwest End Vegetation

This area is characterized by ponderosa pine stands and also sagebrush-grass prairies which are disected by intermittent coulees. Ponderosa pine is usually short in height and small in diameter; therefore, these trees do not have any merchantable value. These ponderosa pine stands are also intermixed with juniper trees and one Douglas fir tree was sighted in the area. A list of the characteristic grasses, forbs and shrubs are as follows: green needlegrass, needle-and-thread, bluebunch wheatgrass, western wheatgrass, blue grama, little bluestem, prairie sandreed; prickly pear, ostragalus, phlox, scarlet globemallow; big sagebrush, silver sagebrush, fringed sagewort, rose, broom snakeweed, Nuttall's saltbush, rubber rabbitbrush. This area is quite productive as distinguished by the diversity of vegetation. The more desirable vegetation is generally found in the coulee bottoms.

VI. WILDLIFE -- A Renewable Resource

In order to be effective in wildlife management, we must understand and study nature's laws. These laws are fixed and unchangeable. These laws are enforced by such basic factors as birth, death, and the needs of living things.

It is a recognized fact that all life, wildlife included, must eat, drink, and find shelter in order to live. It must have a place to raise its off-spring. Only the wild creatures that find enough of the proper kind of food, cover, and water will live.

These natural laws are the foundations for one of the important principles of wildlife managemant. This principle is called "Carrying Capacity". Carrying capacity is the amount of wildlife which any piece of land can support or "carry" at one time.

Good wildlife management is based on fertile soil. Animals can be no healthier than the elements which are contained in the soil.

Wild creatures have the ability to produce young in numbers greater than needed to keep up the population level. An increase in the quality of food, cover, and water could allow more of this number to live.

For this reason, hunting is recommended so that balance may be maintained in the supply of animals. Hunting is a method of taking for useful purposes some of the animals that couldn't survive the winter anyway.

However, man is probably the greatest enemy of our wildlife. Industry and agriculture have destroyed much food and cover and excessive hunting has brought some species near extinction. This is why we have laws which allow hunting of some animals during restricted periods and limit the number that may be killed.

An example of this is logging that opens up sunlit patches so that food plants can grow. An example of this is our expanding cities with more and more land being used for industrial development.

We must practice wise farming and forestry practices which will provide more and better food, cover, and water for wildlife. Game and fish managers have found that the "Ah-Nei" area provides seasonal and yearlong habitat for numerous birds, mammals, reptiles, amphibians, and aquatic and terresterial insects. Different vegetative types within the area create several habitat types providing food and cover for many wildlife species. These natural conditions provide an ecological web of life providing the opportunity to study the inter-relationships among wildlife species.

The following wildlife species may possibly be observed in the area:

Birds	Mammals	Reptiles	Amphibians
Hawks	Rabbits	Rattlesnake	Toads
Owls	Porcupine	Bullsnake	
Doves	Mice		
Sparrows	Chipmunk		
Pinyon Jay	Ground Squirrel		
Meadow Lark	Rockchuck		
Magpie	Bobcat		
Chickadees	Raccoon		
Nuthatch	Coyote		
Robin	Deer		
Mountain Bluebird			

VII. FORAGE -- A Renewable Resource

A part of national forest use, particularly in the western section of the United States, is the grazing of sheep and cattle. Grazing of domestic animals is one of the principal uses of 68 million of the National Forests' 181 million acres. In many places livestock graze on lands also used to produce crops of water, wood, and wildlife. The Forest Service manages the grazing lands of our National Forests very carefully.

Climate

Recreational use season generally extends from early April to mid-November. Annual precipitation is approximately 13 inches and annual temperature ranges from -40°F to 105°F.

Maximum use season ranges from June through October. During this period of time precipitation average is 5 inches, average temperature spans from 75°F to 90°F, humidity level is moderate, and there is occasional light winds.

The wind generally comes from the southwest and averages 10 miles per hour during the summer months and 13 miles per hour during winter months. It is not uncommon to experience winds up to 50 miles per hour during winter chinooks. Snow begins to fall in September and continues intermittently through April. About 30 percent of the annual precipitation occurs during this period and it usually falls as snow.

The average date of the first frost is September 17 and the average date of the last frost is May 20, which allows approximately 120 frost free days for the growing season. Approximately 70 percent of the precipitation occurs as rain during the growing season. Seasonal use varies from 6 to 9 months with occasional opportunity for winter sports during the remaining months.

A LIST OF VOCABULARY WORDS FOR ENVIRONMENTAL EDUCATION

abiotic - refers to the nonliving components of the environment.

algae - primitive green plants; many are microscopic.

annual - a plant which completes its life cycle, from seedling to mature plant, in a single growing season and then dies.

aquifer - a layer of rock or soil that is permeable.

biotic - refers to the living components of the environment.

carnivore - an animal that uses other animals as a food source.

climax community - the kind of community capable of perpetuation under the prevailing climatic conditions.

community - all the plants and animals in a particular habitat that are bound together by food chains and other interactions that are self-perpetuating.

compaction of soil - compressing soils by means of pressure, e.g. from cows' hooves or hikers feet, so that the available space within the soil for air and water is reduced.

competition - an interaction between members of the same population or two populations resulting from a greater demand than supply for a mutually required resource.

condensation - changing water from the vapor to the liquid form; an important part of the hydrologic cycle.

deciduous - a plant, including the trees, which sheds all of its leaves every year at a certain season.

dissolved oxygen - oxygen contained in a solution; usually water.

ecology - the study of the interrelationships of organisms to one another and to the environment.

ecosystem - the community including all the component organisms together with the abiotic environment forming an interacting system.

energy - the ability to perform work.

erosion - the removal and movement of particles of the land surface by wind, water, ice, or earth movements such as landslides and creep.

food chain - a sequence of organisms, including producers, herbivores, and carnivores, through which energy and materials move within an ecosystem.

food web - a complex of interlocking food chains.

fossils - the remains of once-living plants and animals.

ground water - water that is contained in subsurface rock and soil layers.

habitat - the place where an organism lives.

herbivore - an animal that uses plants as a food source.

humus - the dark rich part of the earth formed by the decay of roots, stems, and leaves of plants, as well as the decay of animal matter.

hydrologic cycle - path water takes from precipitation until it evaporates and recondenses in cloud form back to precipitation.

lichen - algal and fungal plants growing together in a symbiotic relationship as an organized whole.

migration - to pass periodically from one region or climate to another; a common pattern among waterfowl and some mammals.

multiple use - a resource management objective based upon maximizing the total goods and services derived as in contrast to managing for a specific resource such as agriculture.

non-renewable resource - a resource of finite supply which cannot be replaced.

omnivore - an animal that can use both plants and other animals as food sources.

parasitism - a population interaction in which one organism (the parasite) obtains needed energy and nutrients by living within or upon another organism called the host.

pH - a measure of the acidity or alkalinity of a solution.

photosynthesis - the process by which light energy is converted by green plants to chemical energy.(food energy)

pioneer species or
community - tree species which initially invade unforested areas.

precipitation - water which reaches the ground from the atmosphere as a result of condensation; includes rain, sleet, snow, etc.

predation - a population interaction in which one organism (predator) kills and eats another organism. (prey)

resources - biologically, everything of natural origin, living and non-living, which humans use and enjoy.

run-off - precipitation that moves from its point of contact with the ground to another on the surface usually as a result of the soil's inability to absorb it.

succession - a gradual replacement of one community by another.

symbiosis - the living together of two or more organisms of different species. (includes parasitism, mutualism, and commensulism.)

tilth - the general shysical condition of soil, which determines how it holds together, absorbs, retains moisture and air, and lends itself to cultivation. Conservation practices, especially of grasses and legumes, tend to improve the tilth, thereby producing a more favorable environment for plant growth.

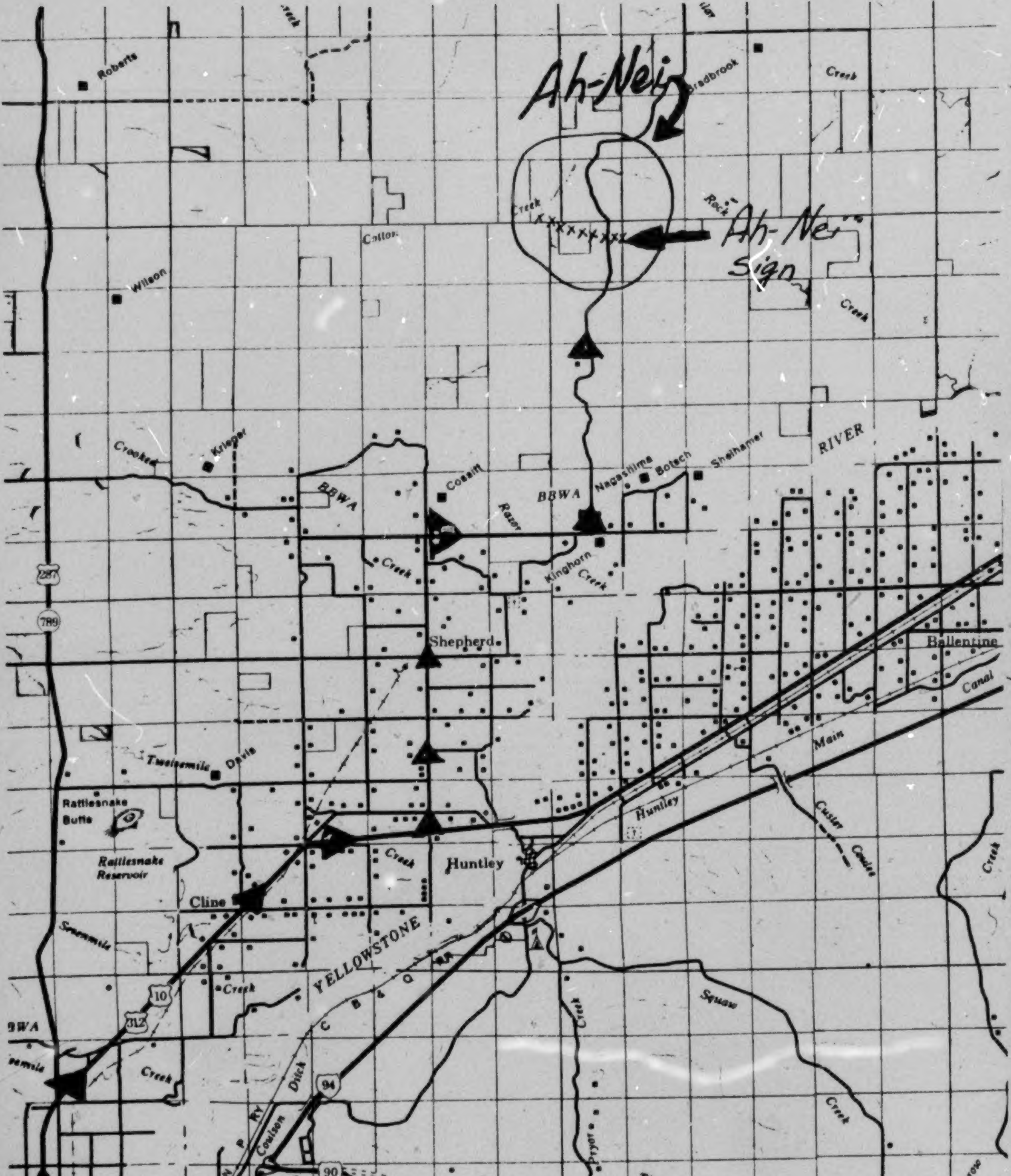
transpiration - water voided as a gas from specialized leaf cells of plants. One important component of the hydrologic cycle.

turbidity - a decrease in visability resulting from the scattering of light by suspended particles in water.

watershed - all the area draining into a stream.

weathering - the chemical decomposition and mechanical disintegration of rock.

wilderness - generallyuncultivated and undeveloped land. Usually the connotation is that the land is in the pristine condition.


Ah-Nei
"Ah-Nei" Sign
Roberts
Bradbrook
Creek
Cotton
Rock
Wilson
Creek
Crooked
Krieger
Cossitt
BBWA
Razor
BBWA
Nagashima
Botsch
Shelhamer
RIVER
Creek
Kinghorn
Creek
287
789
Shepherd
Ballentine
Canal
Main
Twelvemile
Davis
Rattlesnake Butte
Rattlesnake Reservoir
Huntley
Custer
Coulee
Creek
Huntley
Cline
Sevenmile
YELLOWSTONE
C B & Q RR
10
312
Creek
Creek
BWA
Squaw
Creek
Creek
Ditch
Coulson
N P RY
94
90
Creek
Pryor
Three
Wolf
Creek
Arrow
Hirsch Spur
Under
Indian
Lockwood
Creek

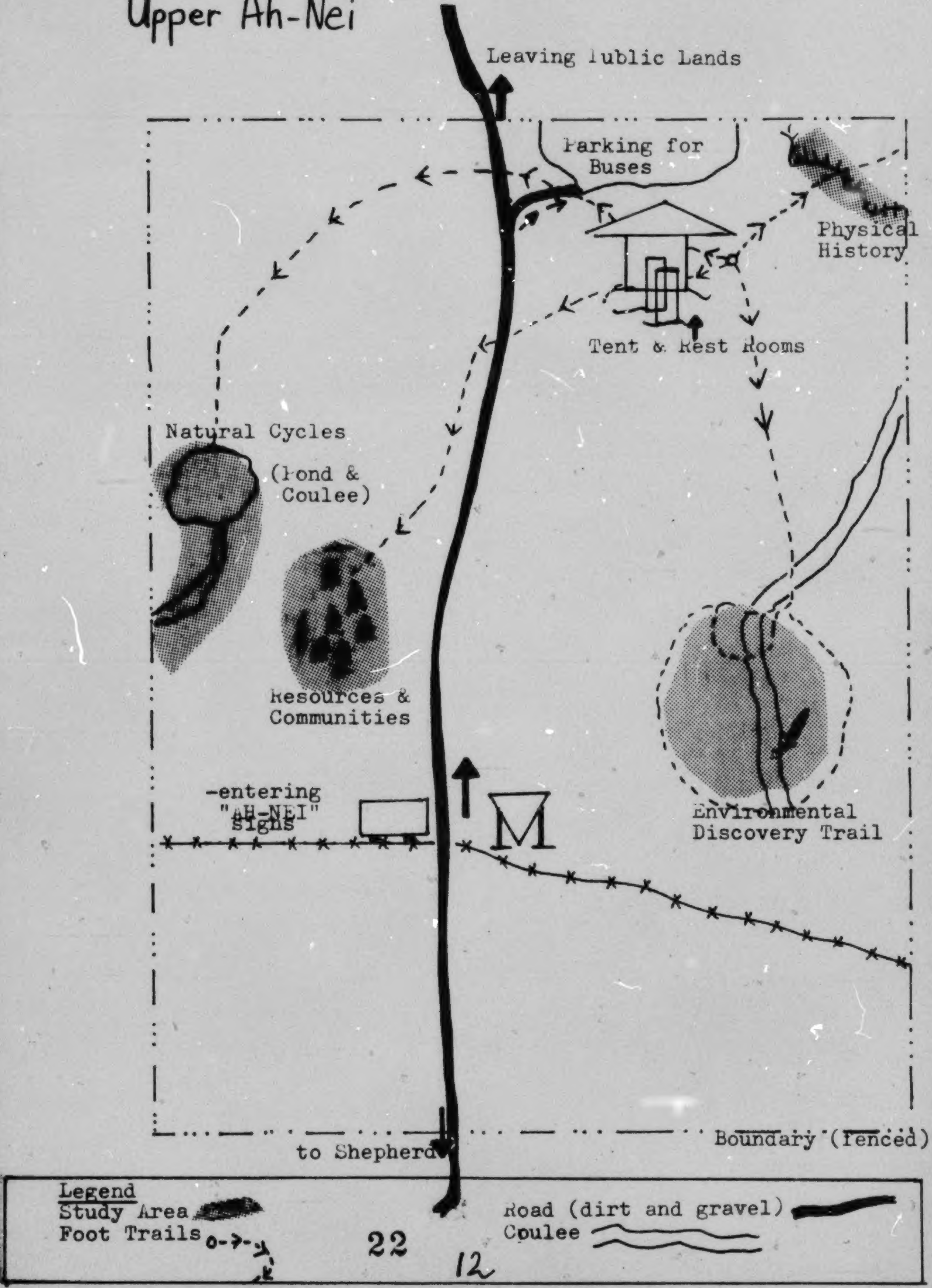
THINGS TO LOOK FOR ON THE WAY TO "AH-NEI"

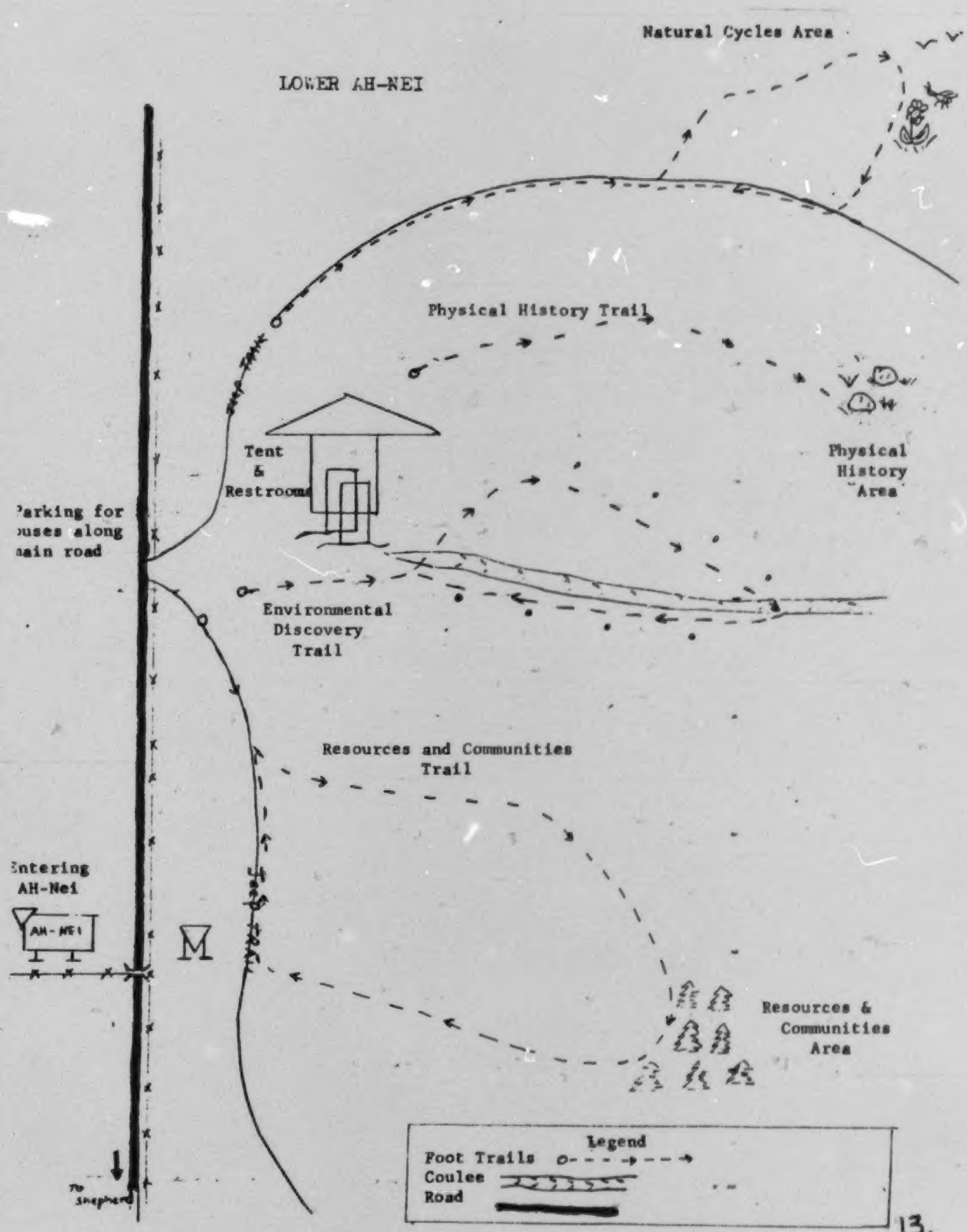
_____ MINIATURE WINDMILL
_____ EGG FARM
_____ HORSE RANCH
_____ BIG SWAMP - 2 ACRES
_____ SCHOOLHOUSE TURNED INTO HOME
_____ BIG DITCH (2)
_____ CATTLEGUARD
_____ ALKALI ON SURFACE (2)
_____ ROCK BUTTE OR PINNACLE
_____ BURNED OFF DITCH
_____ BIG FEED LOT
_____ OLD HOMESTEAD
_____ SANDSTONE RIDGE
_____ OLD SILO

The bus ride through the Shepherd area to Ah-Nei is scenic and interesting. This map and list of things to look for along the way may help your students with map reading and to have a more interesting and enjoyable trip.

You might use alphabetical letters to mark the specific items on the map to coordinate with the list.

Upper Ah-Nei


Leaving Public Lands
Parking for Buses
Tent & Rest Rooms
Physical History
Natural Cycles
(Pond & Coulee)
Resources & Communities
-entering "AH-NEI" signs
M
Environmental Discovery Trail
to Shepherd
Boundary (Fenced)
Legend
Study Area
Foot Trails
Road (dirt and gravel)
Coulee


LOWER AH-NEI
Natural Cycles Area
Jeep Trail
Physical History Trail
Tent
&
Restrooms
Physical
History
Area
arking for
uses along
ain road
Environmental
Discovery
Trail
Resources and Communities
Trail
ntering
AH-Nei
AH-NEI
M
Jeep Trail
Resources &
Communities
Area
To
Shepherd
Legend
Foot Trails o- - - → - - - →
Coulee
Road

Concepts for the E.E. Study Area

This guide is developed around the following strands found in the environment:

Inventory
Patterns or Organization
Interaction within the Cycle
Change and Continuity
Adaptation and Evolution

By understanding the following specific concepts, students will become aware of, understand, and feel one's own relationship with the ecological processes that occur in our environment:

All living things are connected.

Land formations and soils - Where do they come from?

Everything has a home; nearly everything is a home.

Plants and animals that need one another live together in communities, and everything grows to fit where and how it is.

Natural cycles (watershed, soils, vegetation, and animal habitat) continually affect one another and are in a constant state of change.

Consequences of resource depletions versus emphasis on the fact that our basic needs in food, clothing and shelter come from our natural resource base.

Suggested Use

The study areas developed for Ah-Nei have a two-fold purpose:

1. To make students feel at home and immersed in their out-of-door environment. Equipped with this type of sensitivity, they become more interested in technical investigations of the area.

2. To explore the interrelationships that exist in our environment in order to understand man's place in it.

The "Environmental Discovery Trail" offers an opportunity to sensitize students to their environment. It is suggested that classes visit at least part of this Interpretive Trail when visiting Ah-Nei. Primary grade teachers might want to spend most of their time here. Teachers are encouraged to develop longer lesson plans for a stopping station that is particularly interesting to them. For example, a class could conceivably spend all of its time at "mini-climates" or study language arts at the "Apartment House" through a teacher-developed lesson plan.

The investigating study areas - Physical History, Natural Cycles, and Resources and Communities - will require a longer period of study time. This is partly because of the distance to these areas, and partly due to the length of the lessons developed in this guide. It is suggested that teachers select only one of these study areas for concentration during a day's visit. Because of time limitations, it would be difficult to complete investigations in more than one of these areas in a day. Once again, teachers are encouraged to use their own creativity in adding activities to the lessons in this guide.

Ah-Nei is a fantastic area of local, heritage environment. It offers opportunities to investigate nearly every type of relationship in natural eco-systems. It is a place to discover that learning is truly an enjoyable activity.

The Environmental Discovery Trail

1. "A FOREST TREK"

A. DESCRIPTION

A sensory loop designed with a guide rope to be used while students are blindfolded.

> ". . . Every stir in the forest is for the hunter his game; for the fugitive his pursuers. Every bonnet in the street is momentarily taken by the lover to enshroud the head of his idol. The image in the mind is the attention; the preconception is half of the perception of the looked for thing.
>
> "It is for this reason that men have no eyes but for those aspects of things which they have already been taught to discern. Any one of us can note a phenomenon once it has been pointed out, which not one in ten thousand could ever have discovered for himself. Even in poetry and the arts someone has to come and tell us what aspects to single out, and what effects to admire before our aesthetic nature can 'dilate' to its full extent and never with the wrong emotion . . . In short, the only things which we commonly see are those which we preperceive, and the only things which we preperceive are those that have been labeled for us, and the labels stamped into our minds. If we lost our stock of labels we should be intellectually lost in the midst of the world."

- - - William James - PSYCHOLOGY - p.235

B. OBJECTIVE

To make students more aware of their physical environment through use of their basic senses.

C. DIRECTIONS

(1) Blindfold students.

(2) Direct students to hold rope with one hand and put other hand on the shoulder of the person in front of them.

(3) Follow the rope around the area stopping for:

- a. Smell - "Use only your nose. Let the rest of your body relax. Give me three action words about what you smell."
- b. Repeat with touch, hear (listen), taste.

c. "Which sense have we not yet used?" - Sight - "Remove your blindfolds."

d. "Let's continue on to use our sense of sight."

So far you have helped your students:

-- "feel their environment with individual senses

-- realize their dependence on their senses.

(Move to Station 2 - "The Apartment House")

2. "THE APARTMENT HOUSE"

A. DESCRIPTION

A large tree, representing a community of living things.

B. OBJECTIVE

To use our eyes as a sense that we often take for granted.

C. DIRECTIONS

(1) Students lay on their backs looking up with their feet pressed against the base of the tree as spokes in a wheel. (They might pretend they are limbs or roots of the tree.)

(2) "While we are laying on our backs, let's pretend that this tree is an 'apartment house'."

(3) "This 'apartment house' has a basement. Where is it? Does anyone live there?"

(4) "The ground floor is called a lobby. It has carpeting. Can you feel it? What makes the carpeting? Who might live here?"

(5) "There are no elevators in this 'apartment house', but the tree trunk serves as a stairway. How? Does anyone live on the 'stairway'?

(6) "There are many floors in this 'apartment house'. Who might live on these floors?"

(7) "The top floor can be called the "Penthouse.' It forms the canopy of the forest. Many trees together can regulate the temperature of all the other floors, letting in sunshine and precipitation. Does anyone live in the 'Penthouse' of this 'Apartment Building'?"

(8) Discuss taking your eyes for granted.

So far you have helped your students:

- -- to use their eyes to investigate their environment
- -- understand that there are many components working and living together in the environment.

(Move to Station 3 - The Lifebox.)

3. "THE LIFEBOX"

A. DESCRIPTION

A wooden container holding a flask of water and a rock.

B. OBJECTIVE

To introduce to students the basic needs required for all life.

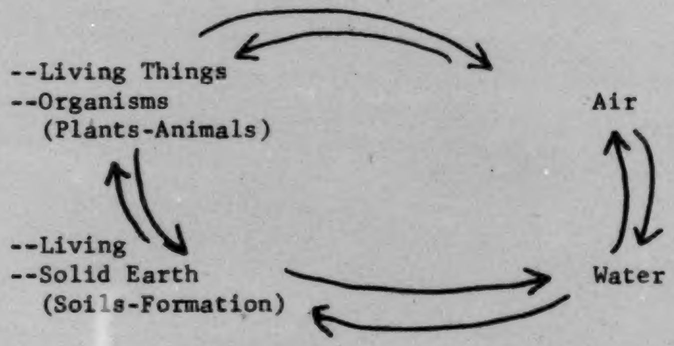
C. DIRECTIONS

(1) Students take turns looking in the box. Everyone should have a chance to see what is inside.

(2) Students are asked to name the 4 basic needs for all life - water, soil, air and sun.

(3) Through communication with the teacher and each other, they realize that 2 of them are in the box, air was always there, and when they opened the box, sunlight came in.

D. ECO-SYSTEMS



So far you have helped your students:

-- understand the 4 basic needs for all life.

(Move to Station 4 - An Earth Cake)

4. "AN EARTH CAKE"

A. DESCRIPTION

A cut in the soil, revealing the layers, vegetative contents and other things present under the ground.

B. OBJECTIVE

To see and examine different ingredients in this part of the earth.

C. DIRECTIONS

(1) Have your students observe the cut in the soil.

(2) "What do you see in the soil?"

(3) "Why are the ingredients in layers?"

(4) "Why are some layers thicker than others?"

(5) Have the students feel and taste the soil layers. "Are there differences?"

(6) "We have examined the ingredients of this earth cake. Now let's look at the decorations. What forms the frosting?"

(7) "What are the decorations on this piece of 'earth cake'?"

(8) "How do these decorations affect the layers of this 'earth cake'?"

So far you have helped your students:

- realize that many elements are contained in soil
- consider the effects that all growing things have an effect on the development of soil.

(Move to Station 5 - Mini-climates)

5. "MINI-CLIMATES"

A. DESCRIPTION

An area that is being "monitored" by a wind vane, temperature and soil thermometers and rain gauges.

B. OBJECTIVE

To make students aware of the various elements that affect climate.

C. DIRECTIONS

(1) Pause and listen to the wind for a moment.

(2) "What does the wind vane tell us about conditions today?"

(3) "How does the wind affect this area?"

(4) "What is 'temperature'? What causes and changes temperature?"

(5) "Is there a different reading on the soil thermometer than on the others? Why?"

(6) The rain gauges are measured and emptied every month. "Does the same amount of rain reach the earth in the trees as in the clearing?"

(7) "Are the plants that are growing in the two places the same? Why or why not?"

So far you have helped your students:

-- to be introduced to elements affecting climate

-- to understand how these elements might affect living things here.

(Move to Station 6 - For Lichen-Likers Only)

6. "FOR LICHEN-LIKERS ONLY"

A. DESCRIPTION

An area with an abundance of lichen on the rocks and trees.

B. OBJECTIVE

To examine a common plant type in this living community.

C. DIRECTIONS (The teacher might want to carry hand lenses and long nails for student-exploring.)

(1) Students explore the kinds of plants growing on the rocks and trees.

(2) "These plants are called 'Lichen'." How many different kinds did you find? Colors? Shapes? Sizes?"

(3) Direct students (without destroying the plants) to look for roots, leaves, stems, seeds.

(4) "What color is the underside of the plant? (white) Color of the top of the plant?" (green)

(5) Discuss the evidence found so far. "How do lichens live?"

Fungus (white)

Symbiotic Relationship

Algae (green)

Algae -- Sunlight
Algae -- Air
Fungus -- Water
Fungus -- Minerals

(6) "Where could the minerals come from?" (rock)

(7) "How does the plant get its water?" (Examine small cups on lichen.)

(8) "How does sunlight affect the lichen? Are there more lichen growing under the rock than on the open surface?"

(9) Air is always there. "Can you remember seeing lichen on trees and rocks in the city where there might be pollution or a large amount of disturbance?"

(10) "How does lichen affect the surrounding environment?"

Consider and discuss:

a. Lichen catches and holds water (frozen water helps break down rock).

b. Lichen dies, decomposes.

c. Lichen traps the energy of the sun.

d. Lichen releases nutrient minerals from the rock.

(11) Examine the lichen. "Which way does it grow?" (Lichen grow out from the center - sometimes taking 100 years per inch on dry rock.)

(12) Using your fingers, measure the age of the lichen here. "Which is the oldest?"

(13) Watch where you walk. "How many years would it take to replace the lichen you destroyed?"

So far you have helped your students:

-- to understand that there are important relationships between living things and their physical environment.

(Move to Station 7 - Magic Mountain)

7. "MAGIC MOUNTAIN"

A. DESCRIPTION

A fallen tree representing a community in this environment.

B. OBJECTIVE

To help students understand the importance of all components in the environment and the interrelationships that exist.

C. DIRECTIONS

(1) "Look closely at this miniature world of the fallen tree. Let's call it 'Magic Mountain'."

(2) "If we all look very close, we will see that it is a tiny community in itself. Everything has a home; nearly everything is a home."

(3) "Who do you see living here? What do each of those things give to their community?"

(4) "Let's pretend we are giants. Blow gently on 'Magic Mountain'. You can create the wind. Stand in front of it and your shadow will block out the sun and change the weather on 'Magic Mountain'."

(5) "If we took away the fallen tree, who would be affected? How?"

(6) "How does man affect his environment?"

So far you have helped your students:

-- understand his relationship to the environment and understand that everything in the environment affects everything else.

(Move to Station 8 - The Lonely Doug Fir)

10. "HAVE YOU THANKED A GREEN PLANT TODAY?"

A. DESCRIPTION

An aesthetic area with an abundance of vegetation.

B. OBJECTIVE

To make students aware of the necessity and importance of green plants in our environment.

C. DIRECTIONS

(1) Students explore the types of plants in the area. "How many can you find?"

(2) "Where do plants come from? What eats the plant? What eats the rabbit? What eats the fox?" etc., more questions. Many answers are possible but all will end with man.

(3) Teacher reads the following poem:

> "This is a plant so new and small
> that hardly shows in the moonlight at all.
> This is a rabbit, hopping, hopping.
> He's hungry for the plant and now he's stopping.
> But, there sits an owl with his big round eyes.
> He's hungry for the rabbit and silently flies.
> But, there sits a fox, not missing a sound.
> Ready to pounce on the owl when he strikes the ground.
> But there comes the farmer, looking things over.
> He gives a whistle to his dog Rover.
> So, the fox slinks away, the big owl goes,
> the rabbit hops home and the plant just grows."

Discuss.

(4) What have you eaten today?

a. Students will tell what they ate for each previous meal.

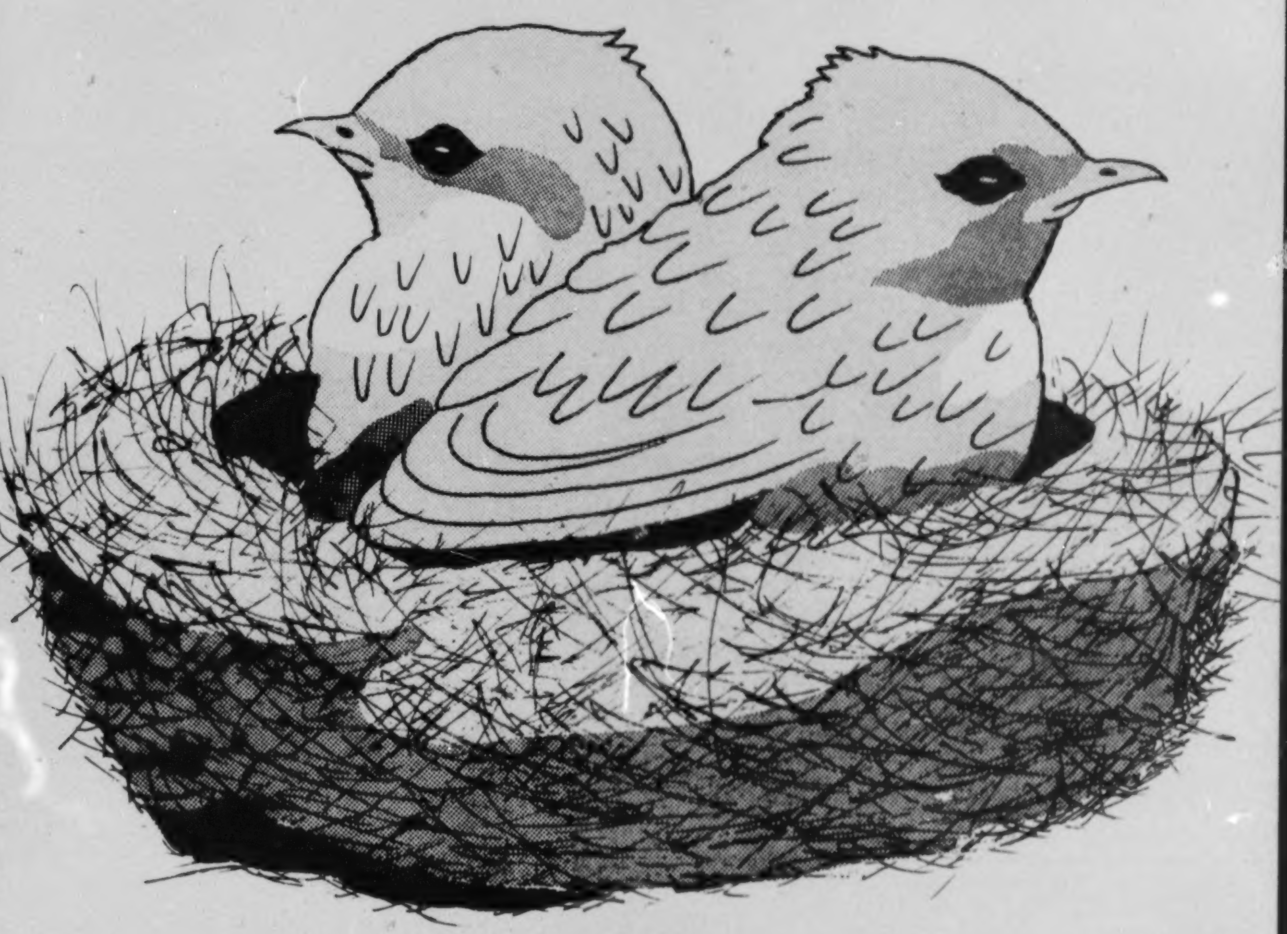
b. Where did the food come from? Where was it grown or raised? If meat is brought up, what does that animal eat?

c. What is your shelter? What is it made of? Where did it come from?

Plants can live without animals. But animals, including man, can't live without plants. Discuss.

So far you have helped your students:

-- appreciate the value of plants in the environment.
-- establish the relationship of man to plants.



Natural Cycles

NATURAL CYCLES - WATER HABITAT - Grades: K-1

KNOWING THE WATER -

OBJECTIVE:

1. Students feel comfortable with water by using their senses.
2. Students realize that plants and animals live in the water.
3. Students understand water can damage as well as nourish plants.

WATER SENSE (30 minutes)

This is an awareness activity designed to allow students to use their senses with water.

MATERIALS NEEDED:

a towel
jelly jars
paper
color crayons
large jugs

A. Lead students to a very shallow part of the stream.

B. Instruct them to use only their sense of hearing (close eyes) and listen to the stream. Verbalize what they hear to the rest of class.

C. Have students use sense of sight. Very quietly, just look at the water. How does it look to each student?

D. Now, wade into the water or just splash arms and face. How does water feel? Let your hand hang loosely in the water, can you feel the water moving?

E. With your hands, cup a drink of water from the stream and spit it out. How does it taste? Does it taste like your water at home?

F. Now, quietly just listen to the stream. Does it sound like thunder or music?

So far you have helped your students:

--use all their senses to familiarize themselves with water.

WHAT'S IN THE WATER? (45 minutes)

This is an activity designed to have students investigate the water for living and non-living things.

A. Lead students to the tank area and have them sit quietly looking in the tank for a few moments. Ask them to look for plants and animals living in the water.

B. Pass out jars and have students dip them in the water, catching speciments of plants and animals. Now each student has their own little mini-tank with animals, and food for them to eat.

C. After each student has their animals and plants in the jar, have them sit down and draw pictures of their "catches", with color crayons. Arrange these pictures around the tank and have each student take turns talking about their picture and specimen.

When this activity is finished, have students pour their water back into the tank.

WATER DAMAGE (30-45 minutes)

This is an activity designed to show students how water affects the environment.

DIRECTIONS:

A. Lead students to an area that shows evidence of erosion from run off. Can students state what happened?

B. Lead students to area of high vegetation on steep slope. Why was there no sign of erosion here? Explain how roots prevent erosion.

C. Find a small area near stream that is dusty, sandy, steep, with no vegetation.

D. Have students fill jugs with water. Pour the water down the steep dusty area and have students watch how water carries soil into the stream in its path. Explain this is a small example of erosion.

E. Have students place stones and sticks in the path of the mini-stream. Where did the water go - over the stones, around them, or did the water carry the stones down the stream with the soil?

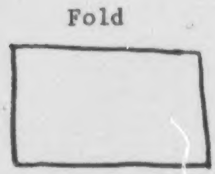
So far you have helped your students:

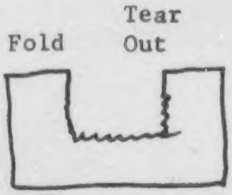
- -- realize that plant coverage is important to prevent erosion
- -- water can cause damage as well as add to nourishment of surroundings

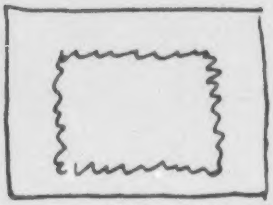
PICTURE FRAMES (20 minutes)

This is a wrap-up activity designed to:

1. Demonstrate how to make frames:







Open up like this

2. Pass out colored paper and have each student tear out his picture frame.
3. Using frames find "works of art" in the environment and frame them (on the horizon, ground, in the water). Experiment using the frames in different ways. Frame each other!

So far you have helped your students:

-- use their eyes to focus on the environment.

NATURAL CYCLES - WATER - Grades: 2-3

INVESTIGATING THE WATER AT AH-NEI - 2½ Hours

OBJECTIVES:

To explore the importance of water to the total environment.

To investigate the water habitat area.

MATERIALS NEEDED:

paper
drawing charcoal
small strainers
hand lense
paper towels
flip chart
magic markers

I. ARE YOU SENSITIVE TO THE WATER?: (30 minutes)

An introductory awareness activity to sensitize students to the environment immediate to the water area.

A. "Only through observation do we become aware."

B. Students are asked to find a "special spot" near the water and sit quietly for about 10 minutes. They should try to become part of the environment. The student is to observe everything in his immediate area using only his 5 senses -- sight, touch, smell, taste, and hearing. He is to apply this particularly to the water in the area.

C. Each student should choose one of his senses. Draw a picture about his impression of the water environment using that sense.

D. Return to the large group. Display and discuss the pictures, students telling about them.

So far you have helped your students:

-- Familiarize themselves with the water environment.

-- Use a creative form of communication in describing their feelings.

II. WHAT'S IN THE WATER?:

Activities developed to help students understand the importance of water to this environment.

A. OBSERVING THE STREAM ENVIRONMENT: (30 minutes)

1. In a large group sit by the creek. Where does the water in this stream come from? What would it look like from the top of the cliff? Where does the water go?

2. Working by yourself, describe some things you see about the stream environment. Use your hand lense and strainers for exploring:

    -- plants
    -- animals
    -- air
    -- rocks
    -- water

QUESTIONS AND DISCUSSION:

1. What did you see? plants, water, animals, air, rocks

2. What do animals need to live in water?

3. Where did you find animals in the water?

4. What guidelines need to be developed when collecting animals from the stream? (Be sure to put them back.)

So far you have helped your students:

-- Explore the aquatic environment.

-- Focus on particular components of that environment.

B. SPECIAL HOMES IN THE WATER: (30 minutes)

1. In pairs students explore for hidden homes in the aquatic environment.

2. Look for "homes" where you wouldn't expect to find them. See if you can find one of each of the following:

    -- in the mud
    -- under rocks
    -- under plant leaves
    -- in algae/plant masses
    -- in holes in the bank

3. Describe the home and the animal you think lives there. Draw it if you like.

QUESTIONS AND DISCUSSION:

Share your findings with the group, answering the following questions about the animals:

1. "Why does that animal choose to make his home there?"
2. "What does the water have to do with his home?"
3. "Are these animals the same in any way?"
4. "What things does this animal need to live?"
5. "What would happen to the animal if the water was not here?"

> So far you have helped your students:
>
> -- Focus on water as a habitat.
>
> -- Understand the effects of environment on animals' homes.

C. WHERE DOES WATER COME FROM?: (30 minutes)

1. Water is one of the four basic needs of life. Tiny drops of water are carried in the air. The tiny drops of water in the air come from evaporation of water from the surface of the earth. Lakes, oceans, rivers, soil, plants and animals all lose water to the air through _____?_____ from their surfaces.

2. Hang a paper towel on a twig in the sun and one in the shade. Which do you think will dry faster? (The towels will dry as the water in them evaporates into the air.)

3. The water that has evaporated from the surface of the earth collects in the air as clouds. When there are enough of the small drops of water in the clouds and they are close enough together, the small drops join to become larger drops. This is called condensation. The larger drops might fall as rain, or if it is cold enough in the clouds as snow, sleet, or hail. Precipitation is the way water returns to the earth from the air. Rain, snow, sleet and hail are all types of _____?_____.

4. You can see that water is always moving. It always goes away, and it always comes back. This happens over and over again, so we say that water moves in a cycle. A ______?______ is something that happens over and over again.

   Evaporation, condensation, and precipitation are important parts of the water cycle. Water leaves the surfaces of the earth by ______?______ , collects in clouds through ______?______, and returns to earth as ______?______, making a complete and continuous cycle. The water cycle is the largest physical action on earth. As you stand here, the water is leaving the lake and going into the air. On a warm, windy day, the lake may lose 1/2 to 3/4 inch of water. It may lose as much as 20-22 inches of water in one month! Lakes don't dry up, though, because water returns as precipitation or rain.

5. Draw cycle on the flip chart.

6. WATERING THE EARTH:

   As individuals have students explore the area:

   -- find the dryest spot
   -- find the wettest spot (out of the water)
   -- find a place where water used to be

QUESTIONS AND DISCUSSION:

1. What are some "dryest" spots you found?

2. What are some "wettest" spots you found?

3. Why are they so dry?

4. Why are they so damp?

5. Where did water used to be? Examine the findings. Why isn't water here anymore?

So far you have helped your students:

-- Conceptualize the hydrologic cycle.

-- Focus on water importance in the environment.

III. CLOUDS: (15 minutes)

An awareness activity designed to sum up water activities.

1. Students lay on their backs - looking up at the clouds.
2. Briefly discuss the formation of clouds and the hydrologic cycle.
3. Have students imagine that the clouds are pictures of things. Give them ideas -- "Can you see a bear in the clouds?" Then let them identify and point out their own images.

So far you have helped your students:

-- Focus on the formation of clouds.

-- Use creative expression in the out-of-door environment.

NATURAL CYCLES - WATER - Grades: 4-5

WATER STUDIES AT AH-NEI - 2½ Hours

OBJECTIVE:

To investigate the watershed and water quality in the Ah-Nei area.

MATERIALS NEEDED:

cardboard tubes as from toilet paper
various colors of cellophane
paper
pencils
water thermometers
graph sheets for water temperatures
small strainers
dishtubs
hand lense
flip chart
magic markers
jelly cups with lids

I. USING A MOVIE CAMERA: (30 minutes)

An awareness activity designed to stimulate students to use their senses in exploring their environment.

Concentrate on seeing by becoming movie cameras. One of the most delicate and amazing lenses in the world is the lense in the human eye. So become cameras as we walk along.

A. WIDE-ANGLE LENSE:

Looking straight ahead, hold your arms out to your sides at eye level. While still looking straight ahead, slowly bring your arms forward. Stop movement when you can first see both thumbs. That's your widest range of vision. Now, using this wide lense, "pan" by letting your eyes play on the horizon, not stopping to focus on anything.

B. TELEPHOTO LENSE:

Use cardboard sighting tubes to zero in and concentrate on a small elements in the environment.

C. MACRO LENSE:

Hold your closed fist up against one eye like a jeweler's monocle and look through it at small objects held close.

D. COLORED LENSE:

Look at the world through lenses made of various colors of cellophane. How different and new everything is with a filter of color!

E. SQUINT:

Put the camera out of focus to see lines and patterns without the confusion of details; then slowly bring your eyes back into focus until they click into a clear picture.

F. UPSIDE DOWN:

Bend and look at things upside down, between your legs, toddler-style.

(These "movie camera" techniques may be used at intervals along the trail, suiting the lense to the scene to be focused upon.)

II. WATER, WATER EVERYWHERE:

Investigations designed to measure water quality and determine criteria involving the surrounding environment.

A. POND PIDDLINGS: (30 minutes)

1. Visit the pond.

    -- what life forms can be easily seen? heard? and felt? (example, animals, plants, sun, water temp., etc.)
    -- record your findings

2. Visit the tank. Answer the same questions. Record your findings.

3. Compare the differences. Discuss.

    -- what things are alike?
    -- what things are different?

So far you have helped your students:

-- Sharpen their observation skills.

-- Focus on observable differences between open-water habitat and contained-water habitat.

B. TAKING THE WATER'S TEMPERATURE: (30 minutes)

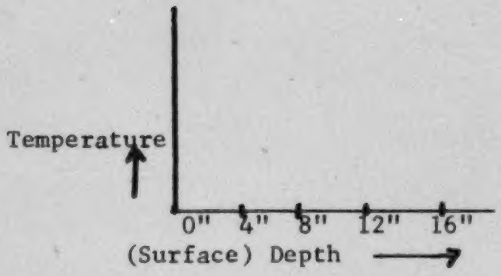
1. Using water thermometers students in teams of 3 will:

    -- Measure and record the temperature of surface of water in the shade.

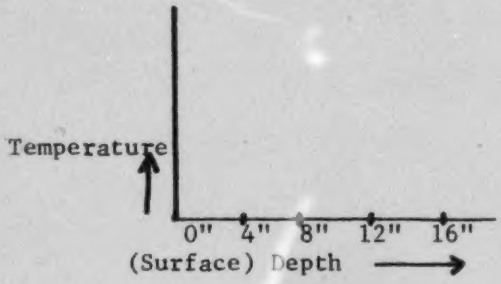
-- Measure and record the temperature of surface in the open where the sun strikes the water.

-- (Use levels in water of 4" intervals in the sun and shade. Try for at least 4 intervals.)

-- Record readings at depths and time of day. Compile your data in graphic form. (line/bar graphs)



Sun



Shade

QUESTIONS AND DISCUSSION:

1. Where is the water coolest? Why?
2. Where is the water warmest? Why?
3. How do temperatures differ in the sun and shade?
4. Would this data be the same in the summer as in the winter?
5. What and who do water temperatures affect? Why?

So far you have helped your students:

- Extend their skills in recording and comparing collected data.
- Understand that water is cooler in the shade and warmer in the sun.
- Realize that water depth decreases temperature (in summer).

C. WHO LIVES HERE?: (30 minutes)

1. In the same groups of 3, students collect organisms and animals from the stream water.

2. Record the following:

   -- Location where the sample was taken.

   -- The temperature of the water at that level.

   -- The water depth.

   (Put your samples in tub of water taken from the stream.)

3. Observe samples with hand lense.

   Record observations.

   Sketch observable features of your samples. (Note: (1) movement, (2) color, and (3) relative size.)

4. Name common animals, using accompanying sheets.

5. Return your specimens to the water.

QUESTIONS AND DISCUSSION:

1. Compare structural parts of animals and discuss their adaptations.

2. Try to observe and determine as a group what feeds off the smaller organisms.

3. Establish a food chain or web in this aquatic community (use flip chart). Can you figure out which animals prey on others?

4. How do the different animals move?

5. Can you find an animal that is reproducing?

6. What happens when temperature increases or decreases in this aquatic community? (Use your temperature graphs.)

So far you have helped your students:

-- Learn that the water contains many living things, some of which are invisible to the naked eye.

-- Understand that water life tends to occur in layers.

-- Water life is affected by environmental conditions -- food supply, temperature, light, etc.

D. THE TANK: (30 minutes)

1. Repeat the previous exercise, exploring the tank of contained water. Return your specimens to the water.

QUESTIONS AND DISCUSSION:

1. How do your findings differ from the open-water investigation?

2. Is your food chain different?

3. Which aquatic environment produced the greatest variety of life?

So far you have helped your students:

-- Examine two different water habitats.

-- Understand the effects of environmental conditions on the animals living in it.

III. MY MINI-AQUARIUM: (15 minutes)

1. Dip a jelly cup into the water in either place. Cap it.

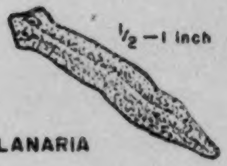
2. Take it home and watch it. Is anyone living in it? Could you call it an "environment"?

So far you have helped your students:

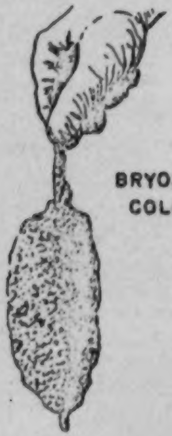
-- Understand that all elements are important to an "environment."

-- Conceptualize - "Everyone has a home; nearly everything is a home."

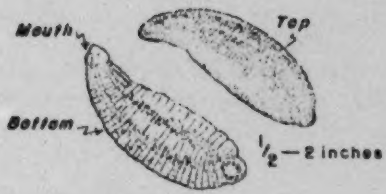
SUB-SURFACE
FRESH WATER ORGANISMS



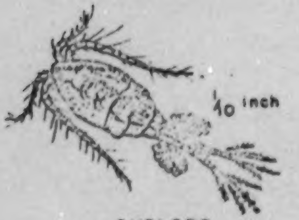
PLANARIA



BRYOZOAN
COLONY

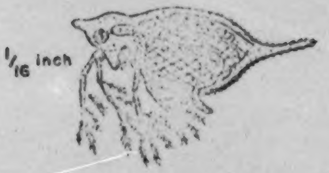


LEECH

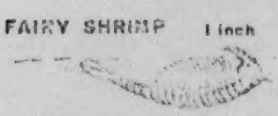


CYCLOPS

DAPHNIA

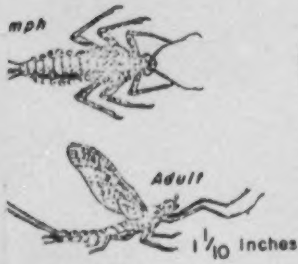


FAIRY SHRIMP

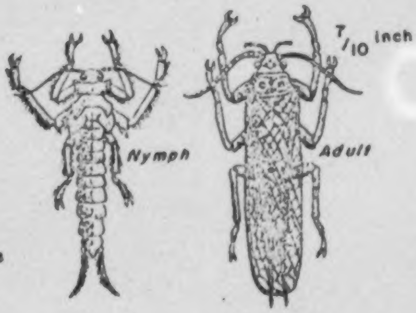


FRESH WATER
SHRIMP

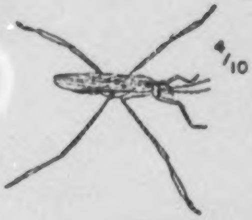
AQUATIC INSECTS



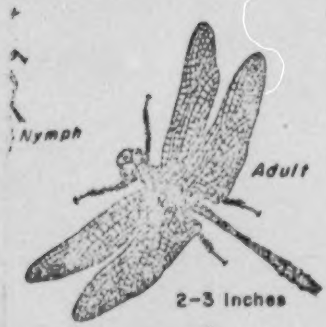
MAYFLY



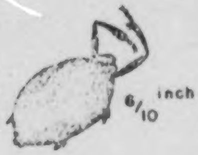
STONEFLY



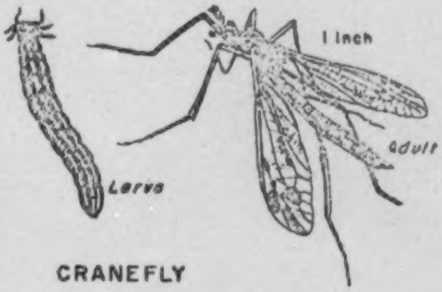
WATER STRIDER



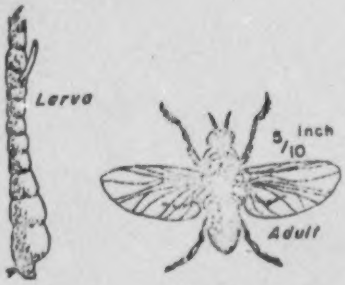
AGONFLY



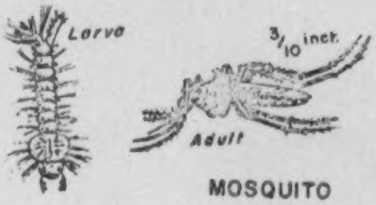
WHIRLIGIG BEETLE



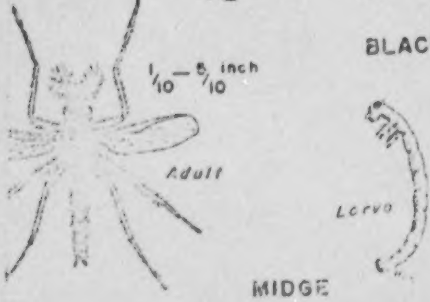
CRANEFLY



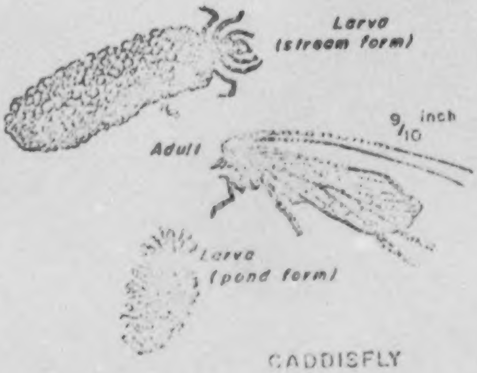
BLACK FLY



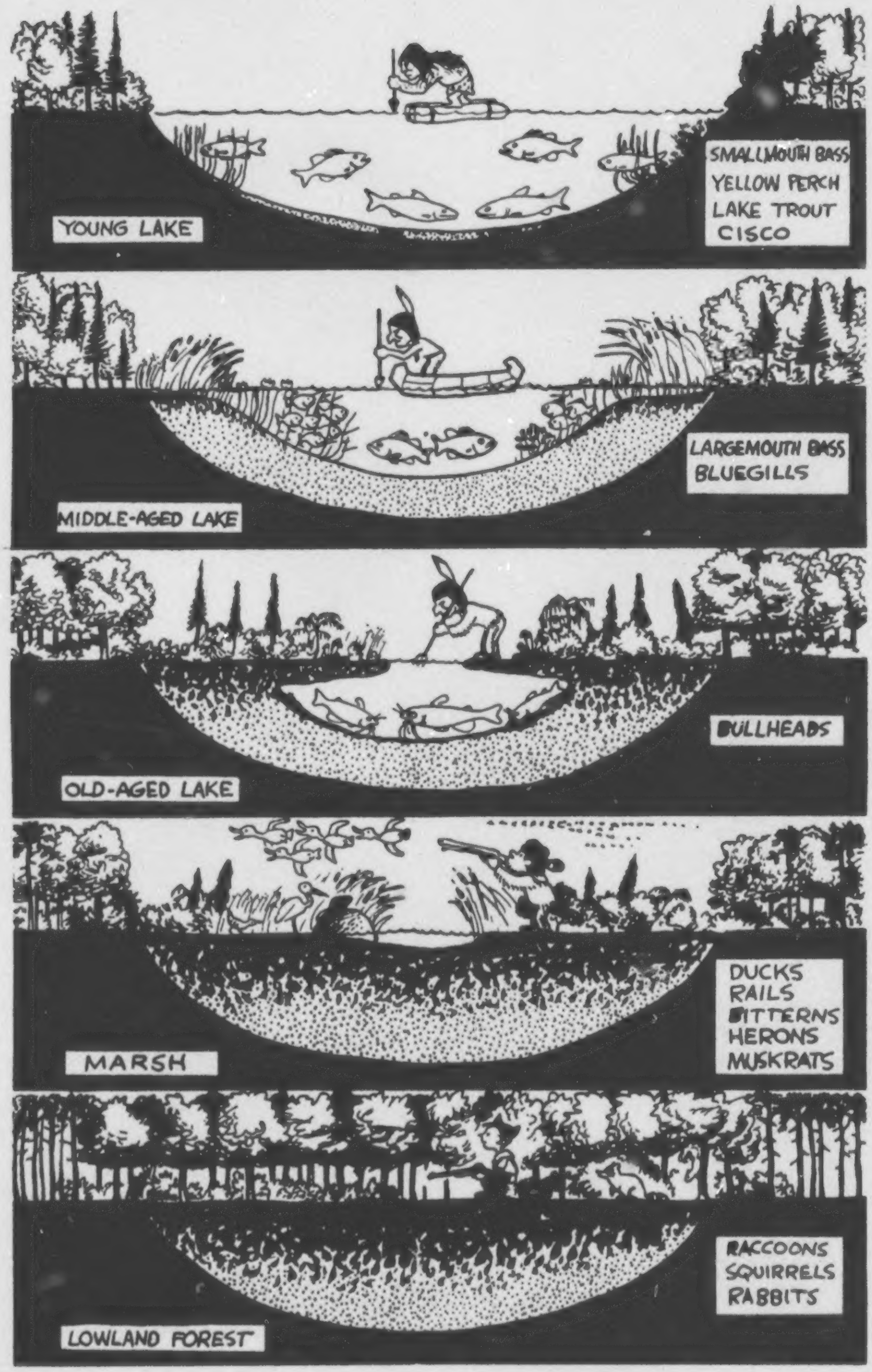
MOSQUITO



MIDGE



CADDISFLY


YOUNG LAKE
SMALLMOUTH BASS
YELLOW PERCH
LAKE TROUT
CISCO
MIDDLE-AGED LAKE
LARGEMOUTH BASS
BLUEGILLS
OLD-AGED LAKE
BULLHEADS
MARSH
DUCKS
RAILS
BITTERNS
HERONS
MUSKRATS
LOWLAND FOREST
RACCOONS
SQUIRRELS
RABBITS

NATURAL CYCLES - VEGETATION - Grades: K-1

PLANT WORLD - 2 Hours

OBJECTIVE:

1. To have students investigate the many uses of plants.

MATERIALS NEEDED:

- primus stove
- metal cup
- matches
- sugar
- scissors
- hoops
- shovel
- pan
- paper for frames
- paper for coloring
- color crayons
- large sheet of tag board

I. A PLANT BREAK (30 minutes)

This is an awareness activity designed to have students become aware of edible plants growing in the wild.

A. Locate mint by square stem, and odor. Have students collect the mint leaves along stream bank in dry area.

B. Set up primus stove and boil water. Steep leaves for about five minutes and share with group.

II. SENSING THE ENVIRONMENT

A. Have group stand around a juniper bush and use only sense of smell. Close all eyes and just sniff. How does it smell?

B. Pick a twig or put your ear close to a twig and roll it between your fingers and listen to the sound you've made.

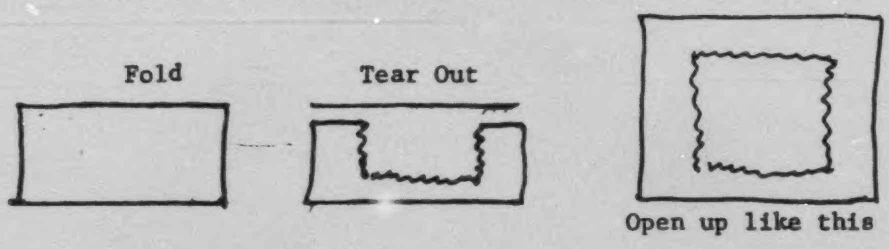
C. Using your hands and cheeks, just touch and feel the juniper bush. How does it feel to you?

D. Have students pick berries for tasting. Now chew on a juniper twig. How does it taste?

E. Now have students use hand lenses to look at the juniper bush. Examine the needles, are they round or sided? Examine the color of the berries. Are they purple or bluish? Examine the base of the plant, is it branchy and bushy or more like a tree trunk?

F. Make picture frames and frame the juniper.

Demonstrate how to make frames:



III. EXAMINING PLANTS AT AH-NEI (1 hour)

An activity designed to help students investigate the variety of plants available at Ah-Nei, particularly the yucca plant.

A. RING AROUND A PLANT (30 minutes)

1. Pass out a hoop to each pair of students.

2. Ask them to stand in a circle with their backs inward.

3. Toss the hoops out so students will be far apart.

4. Ask them to examine the plants found in the hoop. Describe the different leaves. Why are they different? Are there flowers? Berries? Grasses? Sage? Cactus?

5. Have students draw pictures of the different plants they found in their hoop. Can they say where the plant gets its food? What animal eats the plant?

> So far you have helped your students:
>
> -- identify different types of plants in the area
> -- explore a plant's home

B. ZEROING IN ON A YUCCA (30 minutes)

Some hoops had a yucca plant within them. "Do you know which plant is a yucca?"

Discuss--

1. Yucca is sometimes called Spanish Bayonet. Bayonet means a sword or large sharp knife. It is also sometimes called soap weed. How did the yucca get these names?

2. What is yucca used for?

   The Indians used the yucca for weaving ropes. It has been used for soap. The yucca is also a source of food.

   Food - the flowers can be eaten raw. Have students taste them if in blossom. The seed pods may be roasted and eaten. The stalk may be cut into sections, boiled and eaten. The pulp in the leaves may be boiled down into a paste, shaped into sheets and dried.

3. Use the shovel and have students dig up the yucca.

   a. Mash the roots with stones and mix with a little water. You now have SOAP!

4. Select some leaves to be pounded between stones and remove pulp. The fibers life in leaf may be used to weave a rope, or braid a ring.

5. What uses the yucca as a source of food? (Birds, insects, eat blossoms, seeds- worms eat the roots)

So far you have helped your students:

-- explore a plant for its resource and aesthetic value
-- understand early man's relationship to his environment

C. COLOR ME (30 minutes)

A wrap-up activity designed to make students more aware of plants for their aesthetic value.

1. Ask students to choose a flower or plant that is the prettiest to them.

2. Have them sit down close to the chosen specimen and draw, then color the flower or plant.

3. Cut out the pictures and paste them on a collage with a grass border. Allow students to use their imagination in adding to the collage.

So far you have helped your students:

-- use the out-of-door environment for creative expression
-- develop personal feelings for an element in the environment

NATURAL CYCLES - VEGETATION - Grades: 2-3

INVESTIGATING PLANTS AT AH-NEI - 2½ Hours

OBJECTIVES:

1. To investigate the types of plants growing at Ah-Nei and their relationship to the total environment.

2. To focus on the components necessary in any environment for good vegetative cover.

MATERIALS NEEDED:

collection of leaves
  (from the area preferably)
shoebox
large piece of colored paper
glue
small parachute
fish hook
pop gun with a cork
toy boat
mature flower
burr
baggies
flags
yardsticks
plant survey sheets (8" X 10")
hand lenses
large nails
5' lengths of string
scissors
10' strings with pieces of wool
  socks tied to one end

I. ONE-OF-A-KIND: (30 minutes)

An awareness activity to introduce students to the variety of plants in the area.

1. Sit in a circle. Each student is given a particular kind of leaf. Tell them to examine it so carefully that they would be able to pick it out of a pile of different leaves.

2. During the next 5 minutes, they look at it, feel it, hold it at different angles, find distinguishing characteristics, name it, etc.

3. Everyone must now place their leaf in a box, with other leaves no one has examined. Empty the leaves in a pile in the center of the group. Taking turns, have everyone find their leaf.

4. Ask students to share with the group what makes their leaf unique.

5. On a piece of colored paper, make a collage from all the leaves. Take it back to the classroom for display.

So far you have helped your students:

-- Focus on different types of vegetation in the area.

-- Develop their observation skills.

II. MOTHER NATURE'S GARDEN:

Investigating activities designed to expand the students' knowledge of plants and their relationship to the surrounding environment.

A. A SEED DRAG: (10 minutes)

1. This area is loaded with seeds. Let's see how many kinds we can find.

2. Each student receives a 10' string with a piece of wool sock attached to the end. Spend about 5 minutes allowing students to walk around the area, dragging their string behind them. Sit and examine them.

3. Group discussion - how many kinds did you find?

B. HOW DOES MOTHER NATURE PLANT HER GARDEN?: (20 minutes)

1. "Does she use a shovel when planting her seeds?" "Where do the seeds come from? How did they get here?"

2. While students are sitting in a group, the teacher shows them the following objects:

   -- a small parachute
   -- a fish hook
   -- a pop gun with a cork
   -- a toy boat
   -- a mature flower
   -- a burr

3. As you show each object, exaggerate as to how it works (example - airborne parachute with an imaginary story concerning it; a burr getting on a vehicle, someone's coat, and going on a long trip).

4. Attempt to identify with your students the relationship between the objects. (example - objects have all or a part of themselves travel to another place)

5. Students are sent out for 10 minutes to find seeds in the area that can be grouped according to their methods of dispersal. Discuss examples.

QUESTIONS AND DISCUSSION:

1. What does a seed require to grow?
2. Why don't all the seeds produced by a plant grow?
3. What would happen if all the seeds simply dropped beneath the parent plant?
4. Which method offers the widest scattering?
5. Why can't man depend on nature's dispersal of seeds?

So far you have helped your students:

-- recognize that nature has provided many methods for seed dispersal.

-- focus on the types of seeds and their dispersal in this particular environment.

C. HOW DOES YOUR GARDEN GROW?: (30 minutes)

1. Let's begin our exploration of a plant community in this area.

   Discuss community.

2. In pairs, students are instructed to select a vegetated area for exploration, placing their 4 flags in a square yard.

3. Each pair then does a survey of the plants inside their square. (Pass out Data Collection Sheets to students.)(Data Collection Sheet follows)

4. With a magnifier and a sharp nail --

   -- look gently at the roots
   -- examine the leaves
   -- examine the stems
   -- look at the flowers
   -- look for seeds

5. Return to the large group.

   "How many kinds of plants did you find in your square?"

DATA COLLECTION SHEET

	COLOR	FLOWER?	HEIGHT	DRAW THE LEAF
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

"What did you find besides plants in your square?"

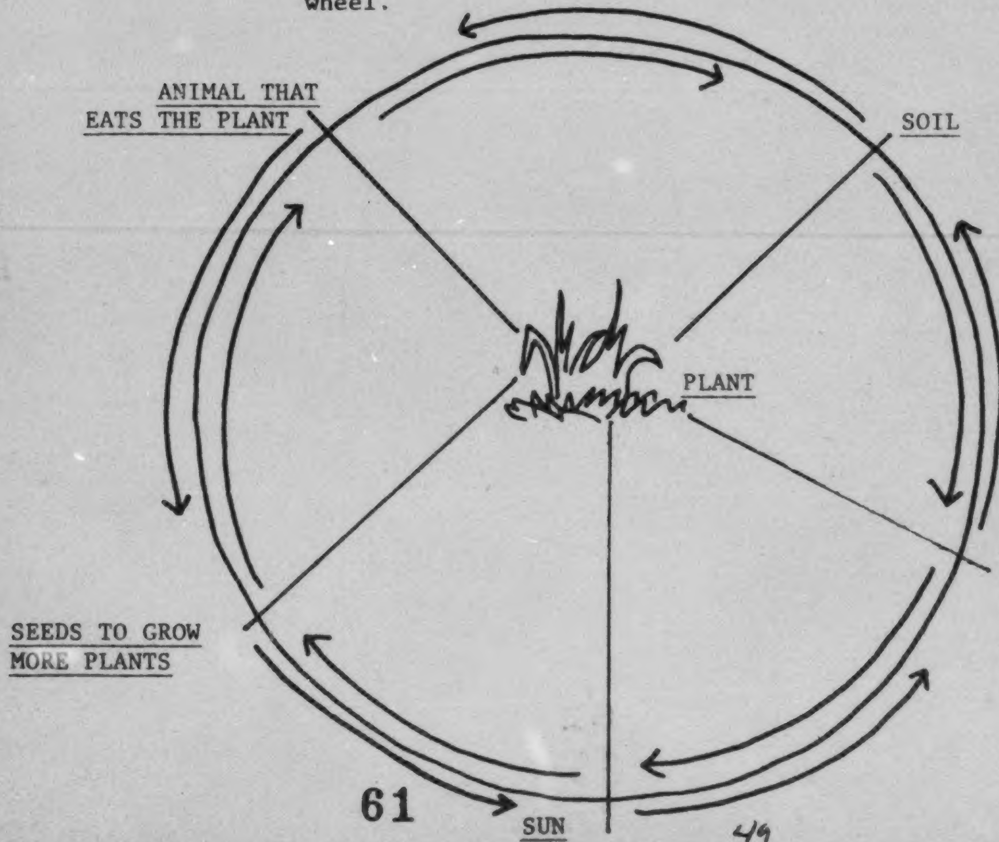
"Why do plants have roots?
Why do plants have leaves?
Why do plants have stems?
Why do plants have flowers? (seeds?)"

So far you have helped your students:

- improve their observation skills
- explore parts of plant
- examine the kinds of plants in the area

D. A PLANT WHEEL: (30 minutes)

1. Select a large plant. Divide your students in pairs.
2. Give each pair a long string. (5 feet) Each pair ties their string to the stem of the plant. The other end is attached to something that is important to the plant, helps it grow, or something that the plant helps. (animal home, etc)
3. Help students so that the strings form spokes of a wheel.



49

4. Discuss the wheel. How does each thing relate to the next?

So far you have helped your students:

-- understand the relationship of plants to other components of the environment.

III. OUR PLANT GALLERY: (30 minutes)

A concluding activity to stimulate students interest in natural colors.

1. Students find a "friendly plant"--one that might be their favorite, and draw it.

2. Gather bits of nature for your crayons--(charred wood, green leaves, pieces of pine cones, juniper twigs and berries, etc.) Color your drawings.

3. When the drawings are completed, select a place for your "gallery". Place all the pictures around the gallery and take a group tour thru it.

So far you have helped your students:

-- discover the varied colors in nature

-- develop a feeling for growing things

NATURAL CYCLES - VEGETATION Grades 4 - 5

INVESTIGATING VEGETATION AT "AH-NEI (2½ hours)

OBJECTIVE:

1. To investigate the types of plants growing at Ah-Nei and their relationship to the total environment.

2. To focus on the components necessary in an environment for good vegetative cover.

MATERIALS NEEDED:

Blindfolds
100' lengths of string
Wooden stakes
Rulers
Transect tablesheets (2)
Thermometer
Saran wrap
Dry cobalt chloride paper
Paper clips
Flagging
Wind vane
Compass
Soil testing kit
Soil thermometer
4 tin cans
2 gallons of water
Small can opener
A sprinkling can
3 milk cartons w/rocks inside
Paper
Magic markers
Charcoal
Drawing paper
Flip chart

"GRASS'N STUFF"

Introduction to the "Ah-Nei" vegetation through inventorying the basic elements, investigating the organization of those elements, and exploring interrelationships and interdependence.

I. AT "HOME ON THE RANGE": (15 minutes)

An introduction to the area through sensory awareness.

A. BLINDWALK THE AREA

1. Blindfold students. Walk them in a line into a vegetated area. Stop at selected places in order to accomplish the

following:

a. Listen to the plants. (Remember--trees are plants). "What do you hear?" (Answer silently to yourself).

b. Smell the vegetation. "What do you smell?" (Answer silently to yourself).

c. Touch--feel the vegetation. To yourself-try to identify specific elements in this environment.

d. Taste the vegetation. (Try to stop at a place that offers juniper, sage, mint, etc. to the students.) Silently describe the taste sensations to yourself.

e. Seeing the vegetation with all your senses. Set the stage by stopping and seating the students at a particularly aesthetic place. They are then told to imagine the area with their blindfolds still on. Remove blindfolds. "Look at the vegetation, using all the sensations experienced with your other senses."

Encourage students to feel a member of the growing things in the area.

So far you have helped your students:

-- use their senses in exploring the environment

-- become comfortable in the out-of-door environment

II. OBSERVING PLANTS AT "AH-NEI":

Activities designed to inventory the types of plants at Ah-Nei.

Using the following directions and the materials provided, select an area to examine the "plants".

A. A TRANSECT SURVEY: (30 minutes)

1. Divide into groups of 5. Groups will inventory an area, using the following transect method. Try to choose areas that differ. Stretch your 100' string along the ground in a straight line, attaching it to wooden stakes at both ends. Examine what you find at every foot along the string or transect, and record on the following table. Identify the object found at the intersecting point of the string and the end of a yardstick.

2. Discuss thee definitions before starting:

Litter - natural or plant debris on the ground surface.

Grasses - plants that are annual or perennial, depending on seeds for reproduction or lasting from year to year from the same root base.

Forb - flowering plants (wild flowers) and other "weeds".

Shrubs - persistent woody plants, smaller than trees.

Sample Every Foot	Rock	Bare Soil	Litter	Grasses	Forb	Shrub	Trees	Sample Every Foot	Rock	Bare Soil	Litter	Grasses	Forb	Shrub	Trees
1								51							
2								52							
3								53							
4								54							
5								55							
6								56							
7								57							
8								58							
9								59							
10								60							
11								61							
12								62							
13								63							
14								64							
15								65							
16								66							
17								67							
18								68							
19								69							
20								70							
21								71							
22								72							
23								73							
24								74							
25								75							
26								76							
27								77							
28								78							
29								79							
30								80							
31								81							
32								82							
33								83							
34								84							
35								85							
36								86							
37								87							
38								88							
39								89							
40								90							
41								91							
42								92							
43								93							
44								94							
45								95							
46								96							
47								97							
48								98							
49								99							
50								100							
								TOTALS							

Summarize your data below:

Item	(from chart) Total ( ) ÷ 100 =	Percentage of Total
Rock		%
Bare Soil		%
Litter		%
Grasses		%
Forb		%
Shrub		%
Trees		%
TOTALS		

Which item had the greatest percentage ______________, coverage ______________, the least ________________?

Do certain plants tend to be associated with certain areas, such as bare places, rocks, protective shrubs, etc.? Which ones? _________________________________

What reasons can you give for this? ________________

1. What types of plants seem to be most abundant?
2. What other observations did you make about the vegetative cover here?
3. What might the above percentages tell us about this area?
4. What might these percentages tell us about erosion in this area?

So far you have helped your students:

-- Focus on the types of plants in the area.

-- Determine the most common plants in the area.

B. DISCUSSION OF VEGETATION: (15 minutes)

(A group "Brainstorming" activity to stimulate individual thinking about plants.)

"BRAINSTORMING"

"B" - Build on other ideas - (Let others ideas stimulate you.)

"R" - Reserve judgment - (Let ideas flow - don't analyze yet.)

"A" - Aim for quantity - (Don't worry about duplication.)

"I" - Imagine wildly - (Let your mind wander.)

"N" - No killer phrases - (Avoid saying, "That's absurd.")

1. Seated in the same viewing place, arrive at a large-group definition of good vegetative cover.

2. Using the same group process, answer the following:

   a. "Why are plants important?" (List on the flip chart.)

   b. "What basic elements are important to plants?" (List on flip chart.) (Try for soils, water, climate - sun and air.)

C. PLANT PATTERNS: (45 minutes)

We have identified basic elements in the environment that are important to plants. We have looked at the kinds of plants in this area. Now let's examine how they work together.

1. Students are divided into three groups. (Each group should have a teacher or aid.) Each group is assigned a basic element important to plants, and given directions on investigating the patterns in that element.

2. Upon completion of your investigation, your group will report your findings to the large group.

   a. Mini-climates - air
   b. Formation and kinds of soils
   c. Water

56

a. MINI-CLIMATES - AIR:

(1) Using the following directions and the materials provided, examine some things in this climate.

(2) You are provided with a thermometer, saran wrap, dry cobalt chloride paper, paperclips, flagging, a wind vane, and a compass.

Activity 1

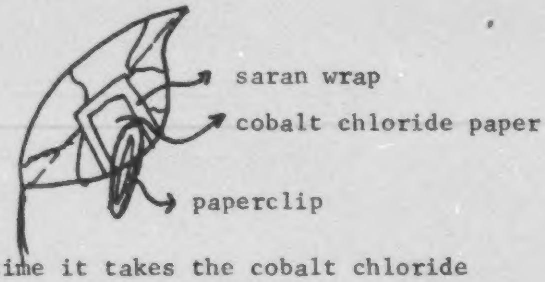
Temperature readings will be taken at different heights above the ground surface. Record the following: (Let the thermometer settle for three minutes before recording your reading; do not move the thermometer when reading it.)

-- 5 feet above the ground in an open, grassy area
-- resting on a rock in the open
-- on the ground in the shade
-- on the ground in an open, grassy area
-- in a water accumulation area

What do these temperatures tell us about this climate?

Activity 2

1. Select 3 different plants. Make a "sandwich" on a leaf of each plant as shown:



2. Measure the time it takes the cobalt chloride paper to turn from blue to pink. This will indicate the rate of "transpiration" (water voided from cells in plant leaves).

3. Compare the three plants.

   How would these transpiration rates affect this climate?

Activity 3

Select a place where a steady breeze seems to be blowing. Using the compass and the wind vane, observe the behavior of the vane for several minutes.

What do you observe that might affect this climate?

Activity 4

Compile your findings on this climate for a report to the group.

b. FORMATION AND KINDS OF SOILS IN THIS AREA:

(1) Using the following directions and the materials provided, examine "soils" on the range.

(2) Materials - soil testing kit, soil thermometer, and a ruler.

Activity 1

Stake out an area 3 feet square on the ground and sift through the top 3 inches of the soil, recording the evidence of plant and animals you observe.

Discuss the following three terms used to describe organic matter at the top of the soil - litter, duff, and humus. From your study above, complete the following chart:

Term and Definition	Describe the feel	List the identifiable parts of plants and animals you found
Litter (identifiable dead things on the surface)		
Duff (partially decomposed (rotted) organic matter - compacted)		
Humus (almost completely decomposed non-identifiable organic matter)		

What can you assume from your findings?

Activity 2 - Soil Temperatures

Make holes in the ground and insert the thermometer. (Allow settlement for 3 minutes before recording the following temperatures)

-- at the base of a rock, but not touching
-- at the base of a shrub, but not touching
-- below the surface in the shade
-- below the surface in the open, grassy area
-- in a water accumulation area

What assumptions can be made from your findings?

What climatic things affect the temperatures of the soil?

Activity 3 - Ingredients in the Layers

(1) Make a cut in the soil so you can observe different layers or horizons. (Many soils have 3 layers or horizons - topsoil, subsoil and parent or original material.)

(2) Measure and record the depth of each major layer you find.

(3) Discuss pH and soil. pH means the degree of acidity or alkalinity in the soil. The degree of pH affects how plants grow. Using the soil testing kit, determine and record the pH of each layer examined. Place soil (a small amount) in the porcelain dish loosely. Use just enough pH reagent (liquid) to saturate the soil sample. Match the color at the edge of the soil sample and dish with the pH color chart.

(4) Using the pH ranges you recorded and the table, "Examples of Plants in pH Range," complete the following chart:

Some Plants That Could Grow Here Based on the pH and Chart	Some Plants Actually Observed Growing Here

59

pH RANGE OF PLANTS

pH 1 4.5 6.5 7 8.5 14

(1 to 4.5 is too acid for most plants) (Most plants do best here) (8.5 to 14 is too alkaline for most plants)

EXAMPLE OF PLANTS IN pH RANGE:

pH 4.0 - 5.0: rhododendrons, camellias, azaleas, blueberries, fern, spruce
pH 5.0 - 6.0: pines, firs, holly, daphne, spruce, oaks, birch, willow, rhododendron
pH 6.0 - 7.0: maple, mountain ash, pansy, asters, peaches, carrots, lettuce, pines, firs
pH 7.0 - 8.0: beech, mock orange, asparagus, sagebrush

What might your findings tell us about soil here?

Compile your findings on soils here for a report to the large group.

c. WATER:

Activity 1 - Surveying the Watershed

Move your groups to the water supply area (creek, pond, etc.).

"Where does this water come from? Where does it go?"

Activity 2 - Water Absorption

Soils vary in their ability to absorb water. During a heavy rainstorm, soils that cannot absorb the rainwater quickly cause the water to run off. As the water runs over the surface, it picks up particles of soil and deposits them elsewhere. The water that runs off carries soil away. The soil that remains is less fertile because some of the richer topsoil has been washed away.

Remove both ends from 3 tin cans. Place a mark on each of the 3 tin cans ½ inch from the rim. Press a can ½ inch deep into each of the following soils:

- -- area where grasses are abundant
- -- bare soil
- -- soil where sagebrush and shrubs are growing

Use the 4th can to pour a full can of water into each of the others. Start timing the rate of absorption as soon as you start to pour the water. Stop timing when no more water remains in the can. Record for each can the location, the appearance of the soil, and the time required for the water to be absorbed by the ground.

Which soil absorbed water the fastest? the slowest?

Which soil would produce runoff most easily?

What factors seemed to contribute to the rapid absorption of water by soil?

How does plant cover affect watershed?

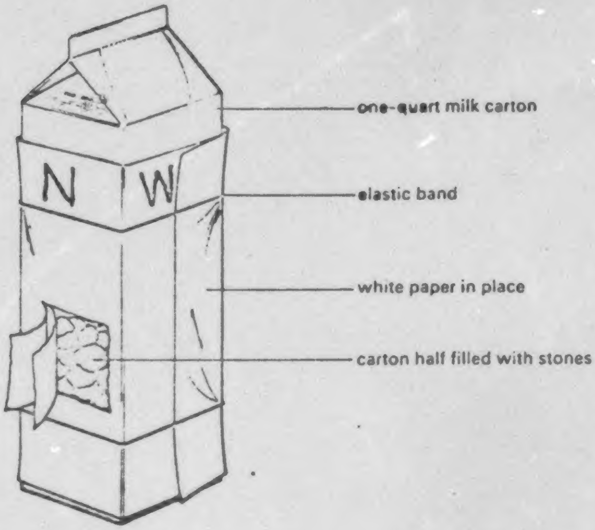
Activity 3 - Erosion

Before soil erosion can take place, the soil particles must be loosened. Falling raindrops have considerable force. As they strike the ground surface, they break up the soil and splash small particles into the air. These particles of soil can be easily carried away by runoff water. The amount of erosion can be measured.

Place your milk cartons in:

-- grassy area
-- bare soil area
-- shrub area

A Splash Pillar



Using a sprinkling can, simulate rain by pouring on the soil around the carton. After your "rain," compare the soil splash marks showing on the white paper.

Which splash pillar had the most soil on it?

Which location suffered most from erosion? the least?

What factors influenced the amount of the splash?

Compile your findings for a report to the large group.

So far you have helped your students:

-- Discover the basic elements necessary to good vegetative cover.

-- Investigate the relationship of plants to other elements in the environment.

D. WHO'S RELATED TO WHO: (30 minutes)

Emphasis on understanding the "community" concept.

1. What did we find? - Group reports on outdoor activities.

(Flip Chart - Have the following written already, without arrows drawn.)

Soils

Plants Climate

Water

2. Who is related to who? Have individuals from each reporting group draw arrows to the other things to which they are interrelated in this environment.

3. What would happen if we took away one of those elements?

4. Can plants live without animals?

5. Can animals live without plants?

So far you have helped your students:

-- Conceptualize interrelationships in the environment.

-- Discover the importance of plants in our environment.

III. MY FAVORITE PLANT: (30 minutes)

Concluding activity to stimulate creative expression in the environment.

A. Choose a favorite plant, Sketch it with charcoal.

B. CINQUAIN: (Japanese poetry about the environment)

1. Name your plant.

2. Write two descriptive words about it.

3. Write 3 action words about it.

4. In 4 or 5 words, describe its relationship to the environment.

5. Sum up your feelings about your plant in one word.

So far you have helped your students:

-- Use creative expression in describing the environment.

-- Discover some personal feelings about an important component in the environment.

NATURAL CYCLES - VEGETATION - Grades: 3-5 (Optional Activity)

LICHEN LOOK'IN IN OUR ECOSYSTEM

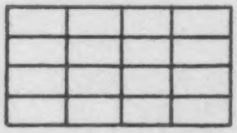
OBJECTIVE:

Let's being this exploration of a special kind of plant community, a major component of the vegetation here.

MATERIALS NEEDED:

- acetate
- wax pencils
- data collecting sheets
- hand lenses
- sharp nails
- eye droppers
- soil test kits
- string
- scissors
- flip chart
- magic markers
- rulers

I. LIFE ON THE ROCKS - ACETATE SURVEY:



Sheet of acetate with grid lines

Each student finds lichen on a rock to lay his acetate sheet. Do a survey.

Data Collection - Lichen discovery, group sharing, awareness of quantity and diversity.

Square	Number Colors	Number Kinds	Amount of Bare Rock

II. FOR LICHEN LOVERS ONLY . . . . HOW DO THEY DO IT?:

With a magnifier and a sharp nail:

- -- look for roots
- -- look for leaves
- -- look for stems
- -- look for seeds

} Lichens are strange plants. A clue for you.

piece of green leaf lichen → "bottom" . . . . is white
piece of green leaf lichen → "top" . . . . is green

Discuss clue and evidence found above . . . . how do lichens live?

Fungus, Algae > Symbiotic Relationship

Algae — Sunlight
Fungus — Water
Fungus — Minerals
Algae — Air

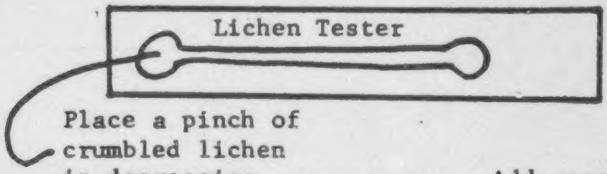
Strange Plants

Minerals for plant growth <		← Needs Minerals	Examine the rocks.
Can survive long periods without rain >	Rain	← Needs Water	Water a lichen with eye dropper. Watch closely for changes.
Forest filtered or tundra direct >	Sunlight	← Needs Light	Look under the rock more, less or same amount of lichens?
Some lichens cannot survive air pollution >	O_2 and CO_2	← Needs Air	Do you remember lichens in the city on large rocks and trunks of trees?

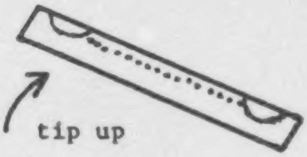
III. HELP SETTLE AN OLD LICHEN SCIENTIST'S ARGUMENT:

Do lichens give off an acid that dissolves rock . . . . making soil which could be used by other living things in the rock ecosystem?

A. Test some rock lichens for acid production.



Place a pinch of crumbled lichen in depression — Add several drops of acid test chemical. Wait two minutes for a reaction.



Acid test indicator will run down into small hole in tester.

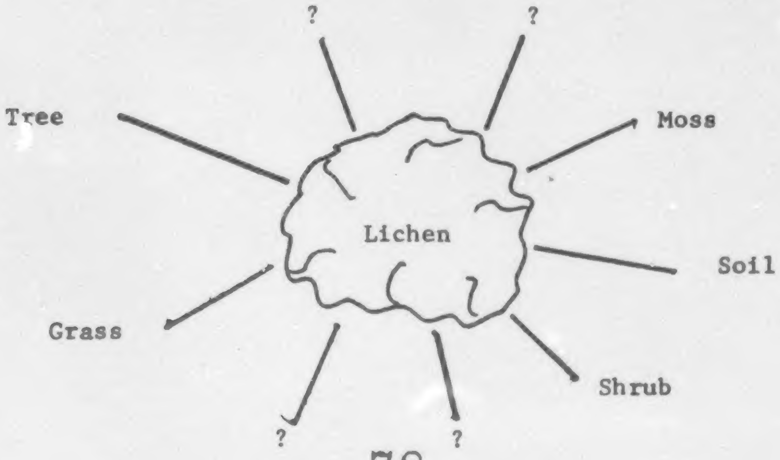
Match the colors - color pH chart.

Did you find an acid? Would rock break up or dissolve in lichen acid?

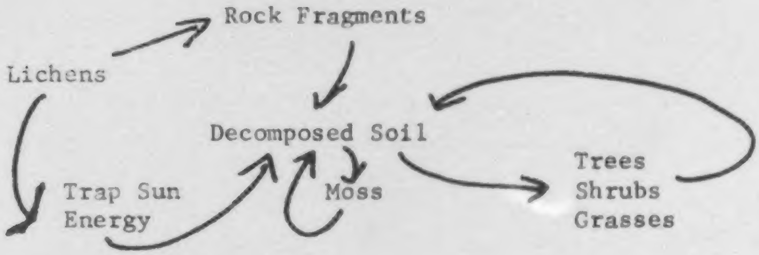
Is there soil on your rock? Did it come from lichen acid or someplace else?

B. LICHEN CONNECTIONS:

Connect your lichen by string to other things on the boulder you think might depend, in some way, on your lichen.



Using a flip chart help students build a diagram of relationships.



C. CONSIDER THE LICHEN:

1. Catches and holds water (freeze breaks rock).
2. Dies, decomposes and builds soil.
3. Catches and holds windblown litter and dust.
4. Traps the energy of the sun for decomposition cycles.
5. Releases nutrient minerals from the rock substratum.

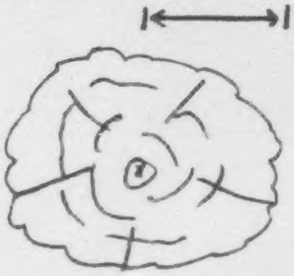
So far you have helped your students:

-- Focus on a common plant type in the living community in a rock ecosystem.

-- Identify important relationships between a common plant and the physical environment.

IV. THINGS CHANGE SLOWLY:

A. SEARCH FOR THE ANCIENT ONES:



Lichens grow out from the center - about one hundred years per inch on dry rock.

Take a ruler and look for the oldest "lichen circle."

One scraping foot of a careless searcher can change the work of dozens of years.

1. IMPLICATIONS OF IMPACT FORM INVESTIGATING LICHEN:

Now might be a good time . . . . circle up and brainstorm other changes that probably occur very slowly . . . . Man makes things happen fast . . . . Nature recovers very slowly.

So far you have helped your students:

- -- Conceptualize some relationships between time and change in an ecosystem.
- -- Become aware of the length of time required to return an ecosystem to normal after being changed by man.

V. INVESTIGATING MOSS LINES:

Find one and follow it:

Use a needle . . . . lift a tiny piece of moss from the line . . . . what's underneath?

Does your moss line depend on:

- -- water being available in the rock, trees, etc.
- -- crystals in the rock
- -- lichens nearby
- -- slant of the rock or tree
- -- color of the rock

Each student should propose a dependency . . . . group share . . . . encourage showing of evidence to support proposal.

So far you have helped your students:

- -- Broaden their understanding of the relationships between the plant community and physical factors in the environment.

VI. THE TIE UP:

Boulder ecosystems are fragile . . . . living things are directly dependent upon some obvious physical factors in the community.

A. STRINGLINE TRANSECT FOR COMMUNITY SURVEY:

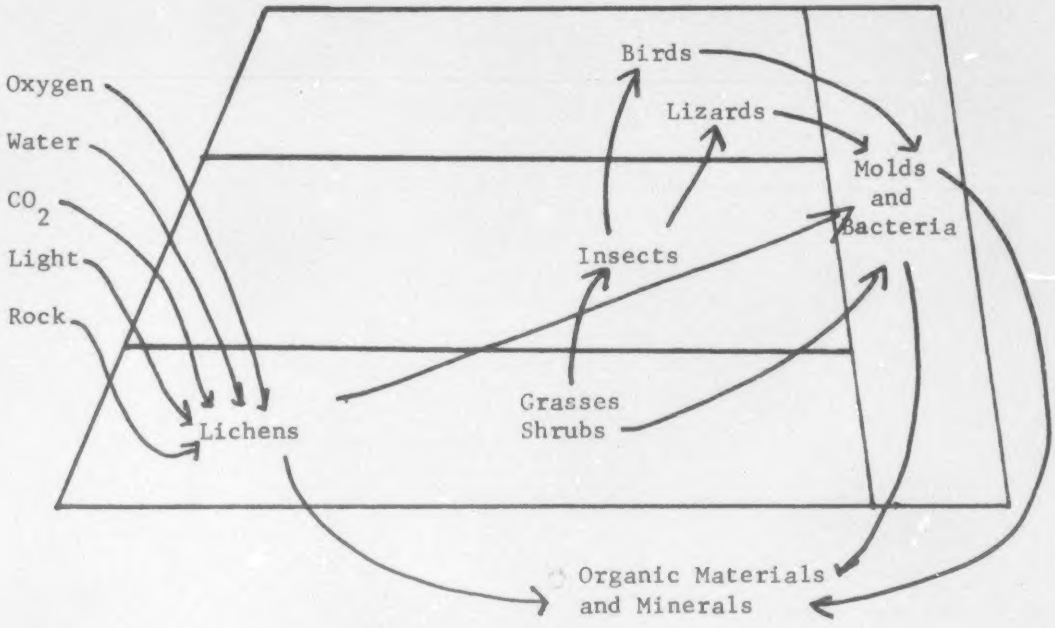
Throw a weighted string over a rock outcropping (each team a different direction) so it goes to the ground on other side.

Teams sample the life every foot and record data on the chart.

Sample	Grass	Soil	Moss	Lichen	Shrub	Tree	Rock
1							
2							
3							
4							
5							
6							
TOTALS							

B. Use a flip chart. Each team reports and data is compiled on a master chart.

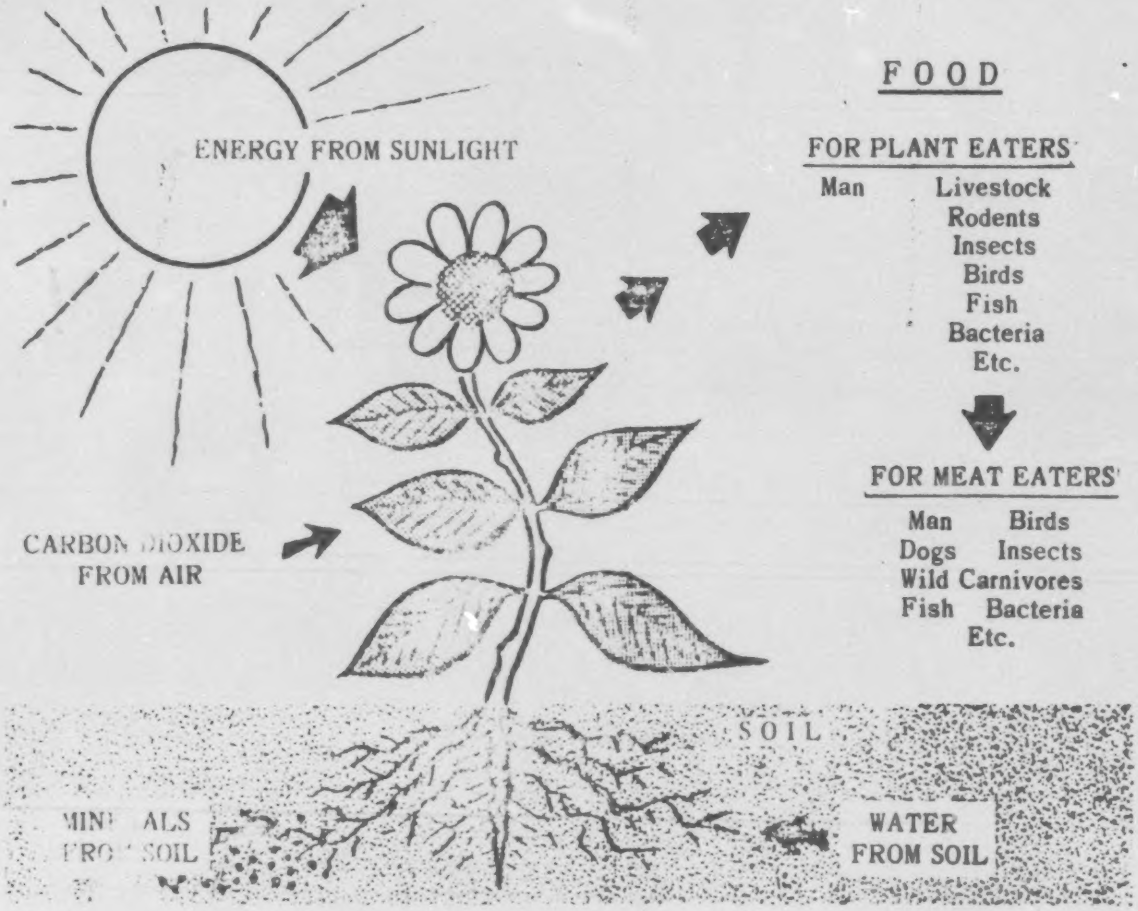
Looking at all that is there, create a drawing with students to show the rock outcropping ecosystem.



So far you have helped your students:

- -- Understand that living things are dependent upon physical factors in the community.

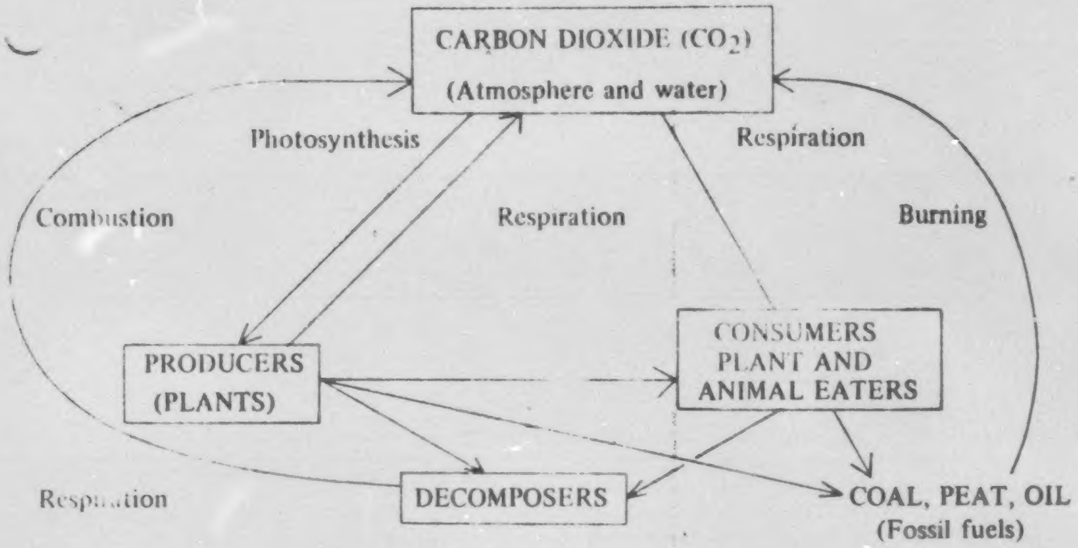
PLANTS MAKE ALL THE FOOD IN THE WORLD



Important Understandings:

A. Light is essential for photosynthesis.

Sunlight is the source of energy for photosynthesis. Anything that interferes with light reaching plants, like smoke or dust in air, or silt in water, reduces the amount of food produced by plants and thus may have important effects on animals including man.



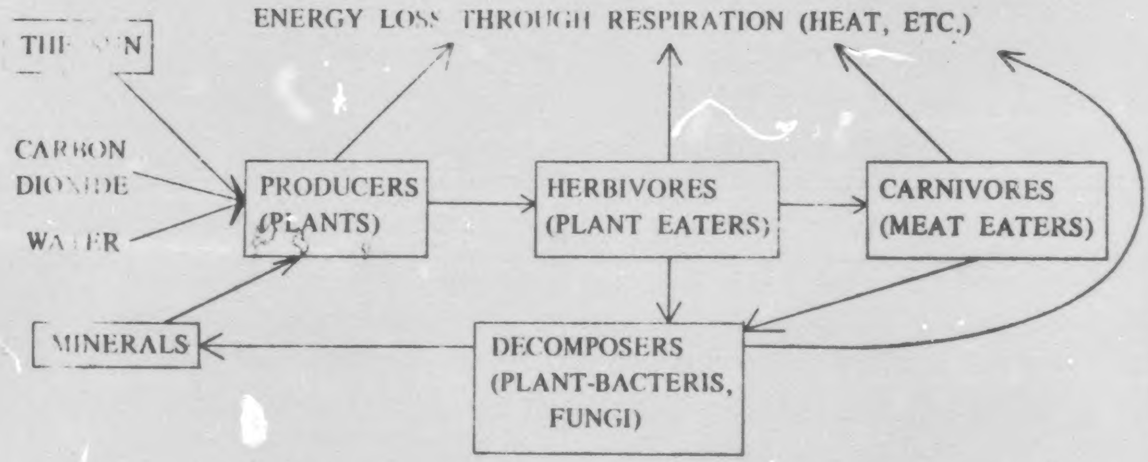
B. Plants recycle carbon (Carbon dioxide) to produce food and are essential stations or stopping points in the carbon cycle that is necessary for all life.
Carbon is an important part of food (carbohydrates, fats, proteins).
Carbon, as part of the gas carbon dioxide, moves from the atmosphere to plants (producers) where it is used in photosynthesis to produce foods and plant tissues. It then moves to consumers (herbivores and carnivores) and/or to decomposers. Eventually, most of it returns to the atmosphere by decomposition, plant and animal respiration (breathing), and burning of plant and animal tissues, including fossil fuels such as coal, peat, and oil.
Anything that causes significant changes in the amount or nature of flow of carbon or other elements of food may have important effects on living things, including man.

C. Soil helps terrestrial (land) plants produce foods.
Soil provides a physical place for land-based plants to grow, a place for roots to attach and anchor the plant.
Soil serves as a reservoir for water and a source of chemical (mineral) nutrients that are absorbed by plant roots and are used in producing food and plant tissues.

D. Water is necessary in plant processes and thus in food production. Water is the solvent that carries minerals, gases, and foods within plants (producers). Anything that contaminates (pollutes) or influences the availability of water may have important effects on producers (plants) and consumers (animals), including man.

E. Food produced by plants is temporarily stored in their tissues. Animals utilize some plant parts for food. Decomposers use some plant material for food. Eventually, all food and tissues produced by plants are reduced to simple substanced (CO_2, H_2O, minerals) and returned to the soil and atmosphere.

A SIMPLIFIED DIAGRAM OF ENERGY (FOOD) FLOW IN THE BIOPHYSICAL ENVIRONMENT


ENERGY LOSS THROUGH RESPIRATION (HEAT, ETC.)
THE SUN
CARBON DIOXIDE
WATER
PRODUCERS (PLANTS)
HERBIVORES (PLANT EATERS)
CARNIVORES (MEAT EATERS)
MINERALS
DECOMPOSERS (PLANT-BACTERIS, FUNGI)

73

Important understandings

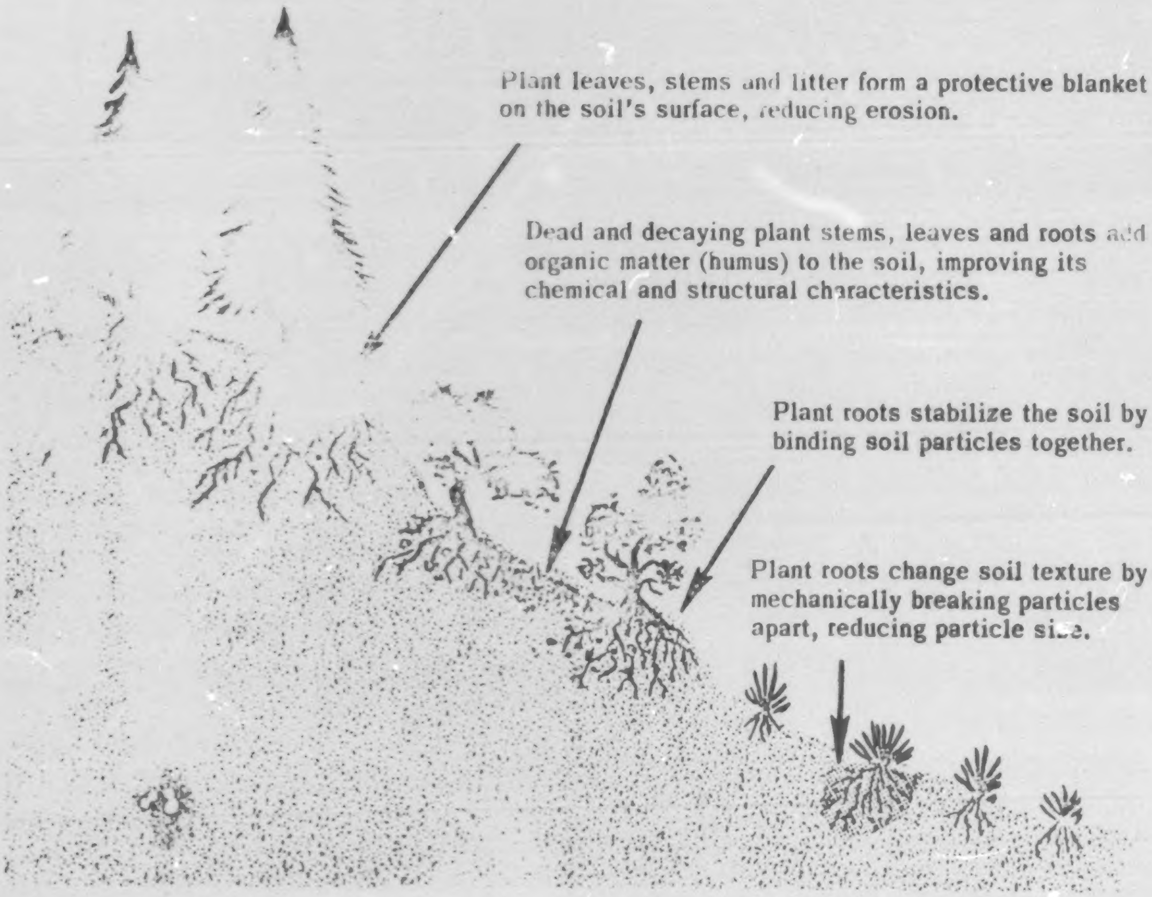
A. Plants and plant litter leaves and stems "cover" the ground to varying degrees, protect the surface from wind and water, slow evaporation of water from the surface, and prevent direct sunlight from reaching the ground.

B. Plant roots stabilize the soil by binding it together.

C. Plant roots change soil texture by mechanically breaking up particles.

D. Plants add organic matter to soil as leaf, stem, and root litter. Some plants add chemical elements to the soil which may change its chemical and structural nature.

PLANTS AFFECT THE LAND YOU LIVE ON



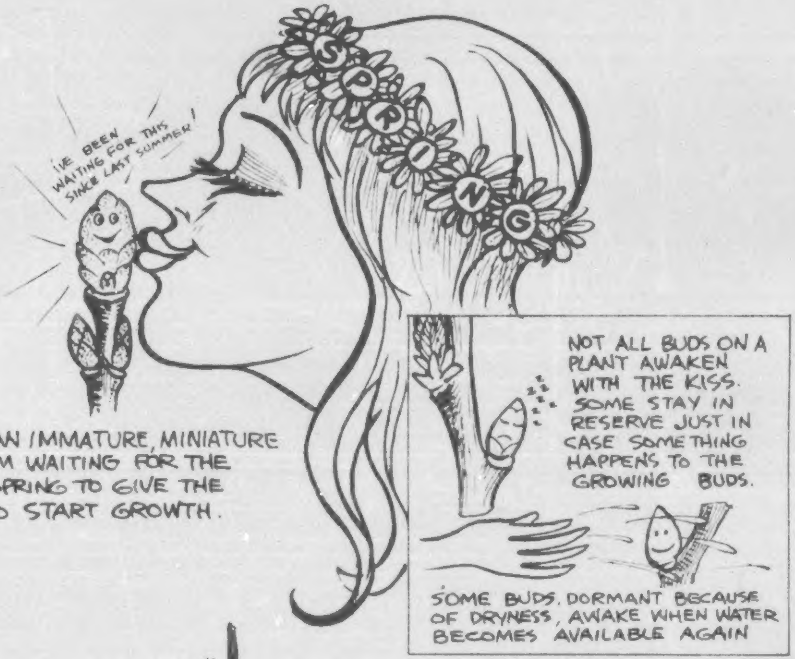
Plant leaves, stems and litter form a protective blanket on the soil's surface, reducing erosion.

Dead and decaying plant stems, leaves and roots add organic matter (humus) to the soil, improving its chemical and structural characteristics.

Plant roots stabilize the soil by binding soil particles together.

Plant roots change soil texture by mechanically breaking particles apart, reducing particle size.

ABOUT BUDS



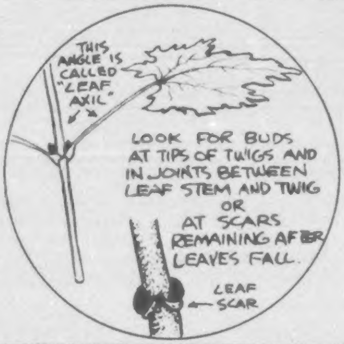
I'VE BEEN WAITING FOR THIS SINCE LAST SUMMER!
SPRING
z z z

A BUD IS AN IMMATURE, MINIATURE PLANT STEM WAITING FOR THE KISS OF SPRING TO GIVE THE SIGNAL TO START GROWTH.

NOT ALL BUDS ON A PLANT AWAKEN WITH THE KISS. SOME STAY IN RESERVE JUST IN CASE SOMETHING HAPPENS TO THE GROWING BUDS.

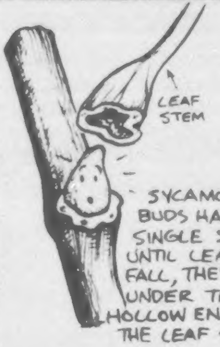
SOME BUDS, DORMANT BECAUSE OF DRYNESS, AWAKE WHEN WATER BECOMES AVAILABLE AGAIN

DEPENDING UPON TYPE OF BUD, THE MINIATURE STEM INSIDE MAY DEVELOP EITHER LEAVES OR FLOWERS OR BOTH.

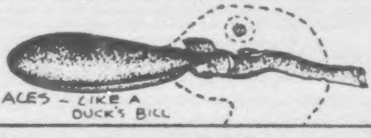


THIS ANGLE IS CALLED "LEAF AXIL"
LEAF SCAR

LOOK FOR BUDS AT TIPS OF TWIGS AND IN JOINTS BETWEEN LEAF STEM AND TWIG OR AT SCARS REMAINING AFTER LEAVES FALL.

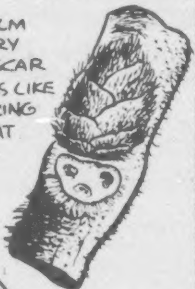


SYCAMORE BUDS HAVE A SINGLE SCALE. UNTIL LEAVES FALL, THEY HIDE UNDER THE HOLLOW END OF THE LEAF STEM.

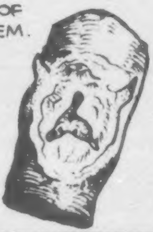


TULIP TREE BUDS CONSIST OF 2 SCALES - LIKE A DUCK'S BILL

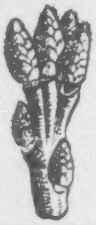
BUDS COME IN ALL SIZES AND SHAPES. BY LEARNING THE BUDS AND ASSOCIATED LEAF SCARS OF THE VARIOUS SPECIES, WINTER IDENTIFICATION OF TREES AND SHRUBS BECOMES EASIER.



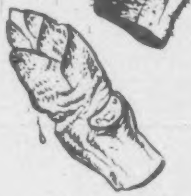
SLIPPERY ELM HAS A HAIRY BUD. LEAF SCAR "FACE" LOOKS LIKE IT'S WEARING A FUR HAT



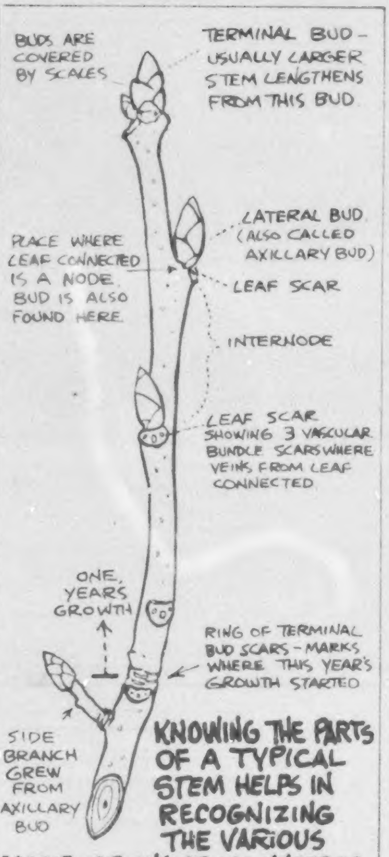
BLACK LOCUST BUDS ARE SHY- THEY'RE HIDDEN UNDER THE CRACKS IN THE LEAF SCARS.



BUDS ON BLACK OAK ARE CLUSTERED AT THE TWIG END. MOST OAKS CLUSTER IN THIS WAY.

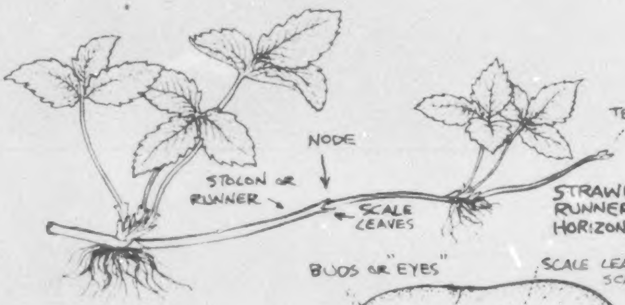


BALSAM POPLAR BUDS ARE LARGE, STICKY, FRAGRANT AND RESIN COATED.


BUDS ARE COVERED BY SCALES
TERMINAL BUD - USUALLY LARGER STEM LENGTHENS FROM THIS BUD
LATERAL BUD (ALSO CALLED AXILLARY BUD)
PLACE WHERE LEAF CONNECTED IS A NODE. BUD IS ALSO FOUND HERE
LEAF SCAR
INTERNODE
LEAF SCAR SHOWING 3 VASCULAR BUNDLE SCARS WHERE VEINS FROM LEAF CONNECTED
ONE YEARS GROWTH
RING OF TERMINAL BUD SCARS - MARKS WHERE THIS YEAR'S GROWTH STARTED
SIDE BRANCH GREW FROM AXILLARY BUD

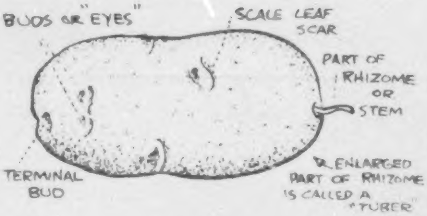
KNOWING THE PARTS OF A TYPICAL STEM HELPS IN RECOGNIZING THE VARIOUS MODIFICATIONS STEMS UNDERGO.

BUDS, WHICH ARE PRODUCED ON STEMS, COME IN ALL SHAPES AND SIZES. THE STEMS ALSO ARE MODIFIED IN MANY WAYS. BELOW ARE THREE EXAMPLES



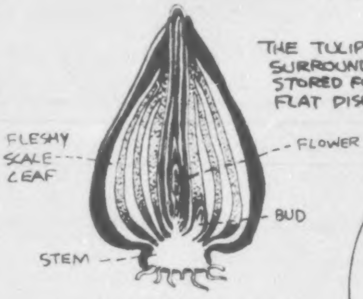
STRAWBERRY RUNNERS ARE HORIZONTAL STEMS

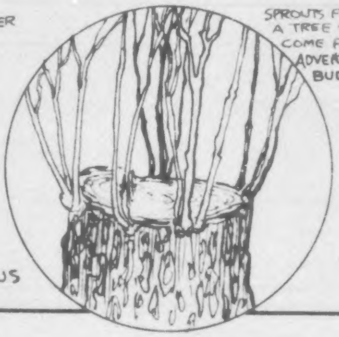
THE POTATO IS AN ENLARGED UNDERGROUND STEM CONTAINING LARGE AMOUNTS OF STORED FOOD



ENLARGED PART OF RHIZOME IS CALLED A "TUBER"

THE TULIP BULB IS A RESTING BUD SURROUNDED BY THICK LEAVES FULL OF STORED FOOD. THE STEM IS JUST THE FLAT DISK AT THE BOTTOM

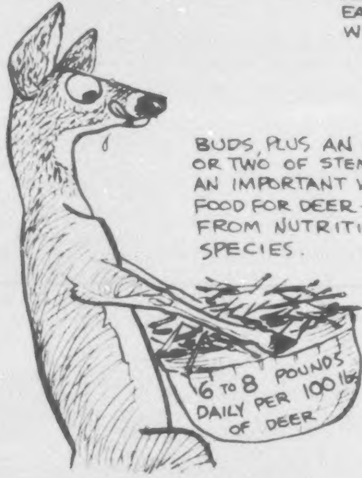




SPROUTS FROM A TREE STUMP COME FROM ADVENTITIOUS BUDS.

BUDS SOMETIMES FORM AT PLACES OTHER THEN IN AXILS OF LEAVES OR AT THE STEM TIP. THESE ARE CALLED ADVENTITIOUS BUDS.

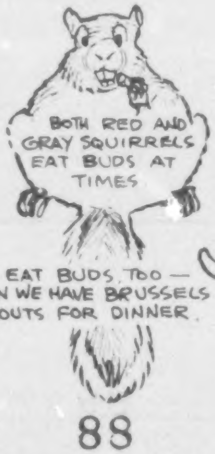
BUDS AS FOOD


6 TO 8 POUNDS DAILY PER 100 lbs OF DEER

BUDS, PLUS AN INCH OR TWO OF STEMS ARE AN IMPORTANT WINTER FOOD FOR DEER — IF FROM NUTRITIOUS SPECIES.

IN THE WINTER, BUDS (ESPECIALLY ASPEN) ARE THE NUMBER ONE FOOD OF RUFFED GROUSE. OTHER BUDS EATEN INCLUDE HAZEL, BIRCH, WILLOW AND BLUEBERRY.

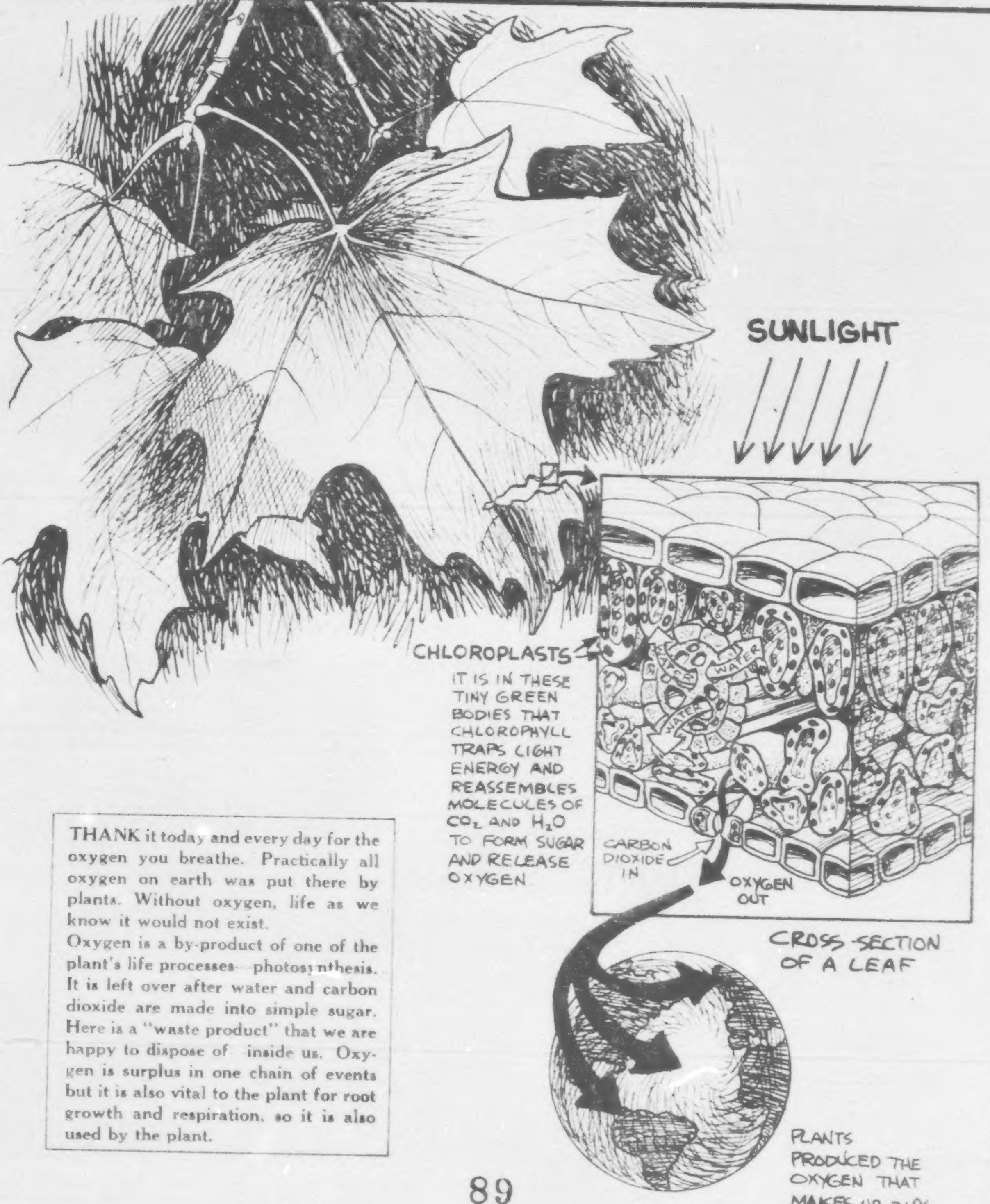
THE BIGGER MALE FLOWER BUDS ARE THE RICHEST SOURCE OF NUTRIENTS AVAILABLE IN THE WINTER AFTER SNOW COVERS GROUND



BOTH RED AND GRAY SQUIRRELS EAT BUDS AT TIMES

WE EAT BUDS, TOO — WHEN WE HAVE BRUSSELS SPROUTS FOR DINNER.

HAVE YOU THANKED A PLANT TODAY?

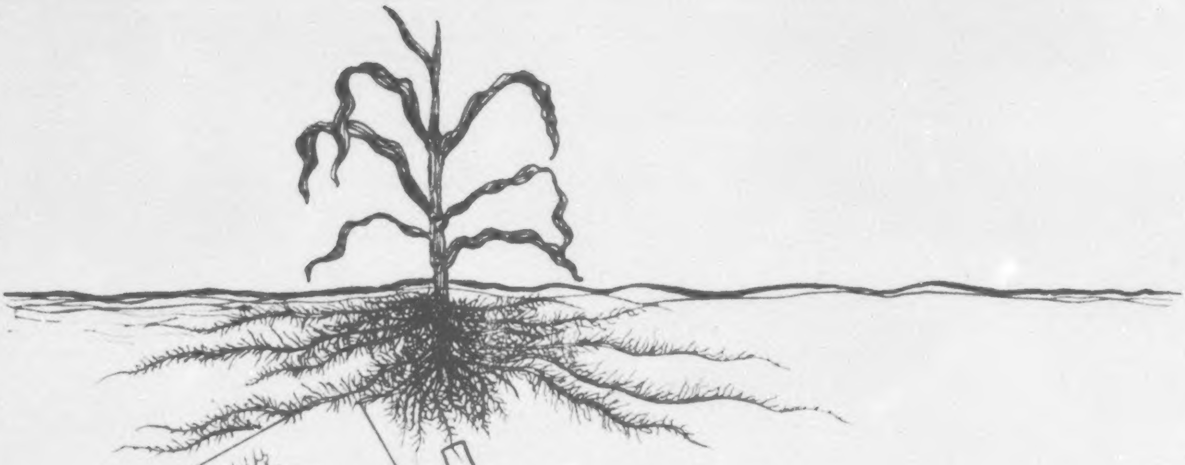


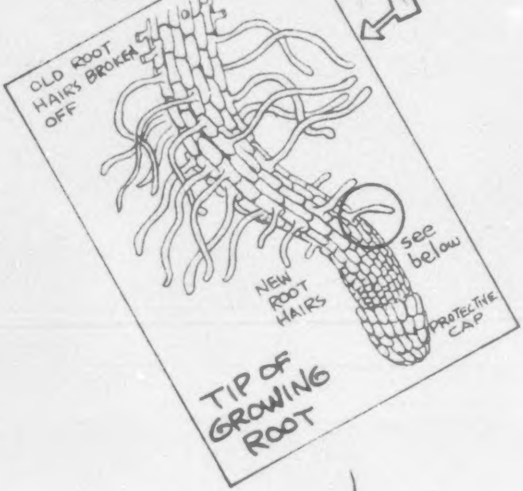
SUNLIGHT
CHLOROPLASTS
IT IS IN THESE TINY GREEN BODIES THAT CHLOROPHYLL TRAPS LIGHT ENERGY AND REASSEMBLES MOLECULES OF CO_2 AND H_2O TO FORM SUGAR AND RELEASE OXYGEN
WATER
WATER
WATER
CARBON DIOXIDE IN
OXYGEN OUT
CROSS-SECTION OF A LEAF

PLANTS PRODUCED THE OXYGEN THAT MAKES UP 21% OF EARTH'S ATMOSPHERE

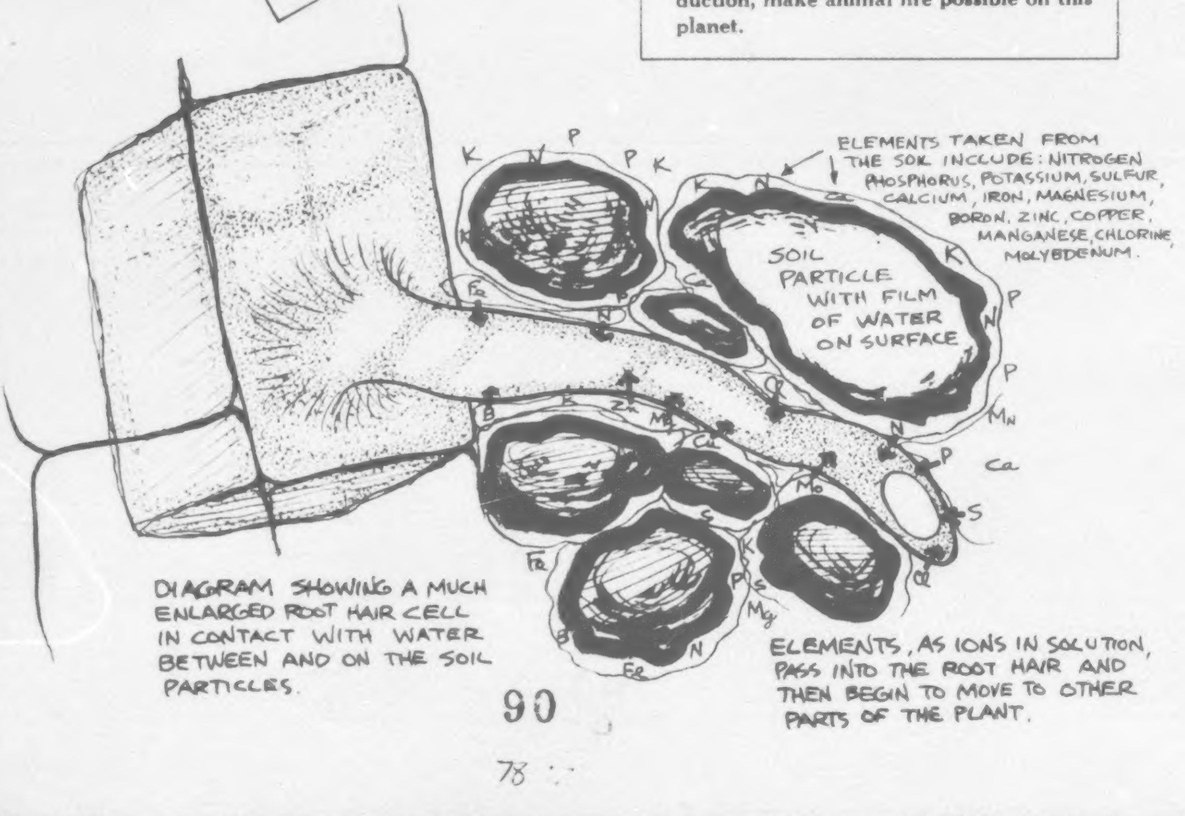
THANK it today and every day for the oxygen you breathe. Practically all oxygen on earth was put there by plants. Without oxygen, life as we know it would not exist.

Oxygen is a by-product of one of the plant's life processes—photosynthesis. It is left over after water and carbon dioxide are made into simple sugar. Here is a "waste product" that we are happy to dispose of—inside us. Oxygen is surplus in one chain of events but it is also vital to the plant for root growth and respiration, so it is also used by the plant.





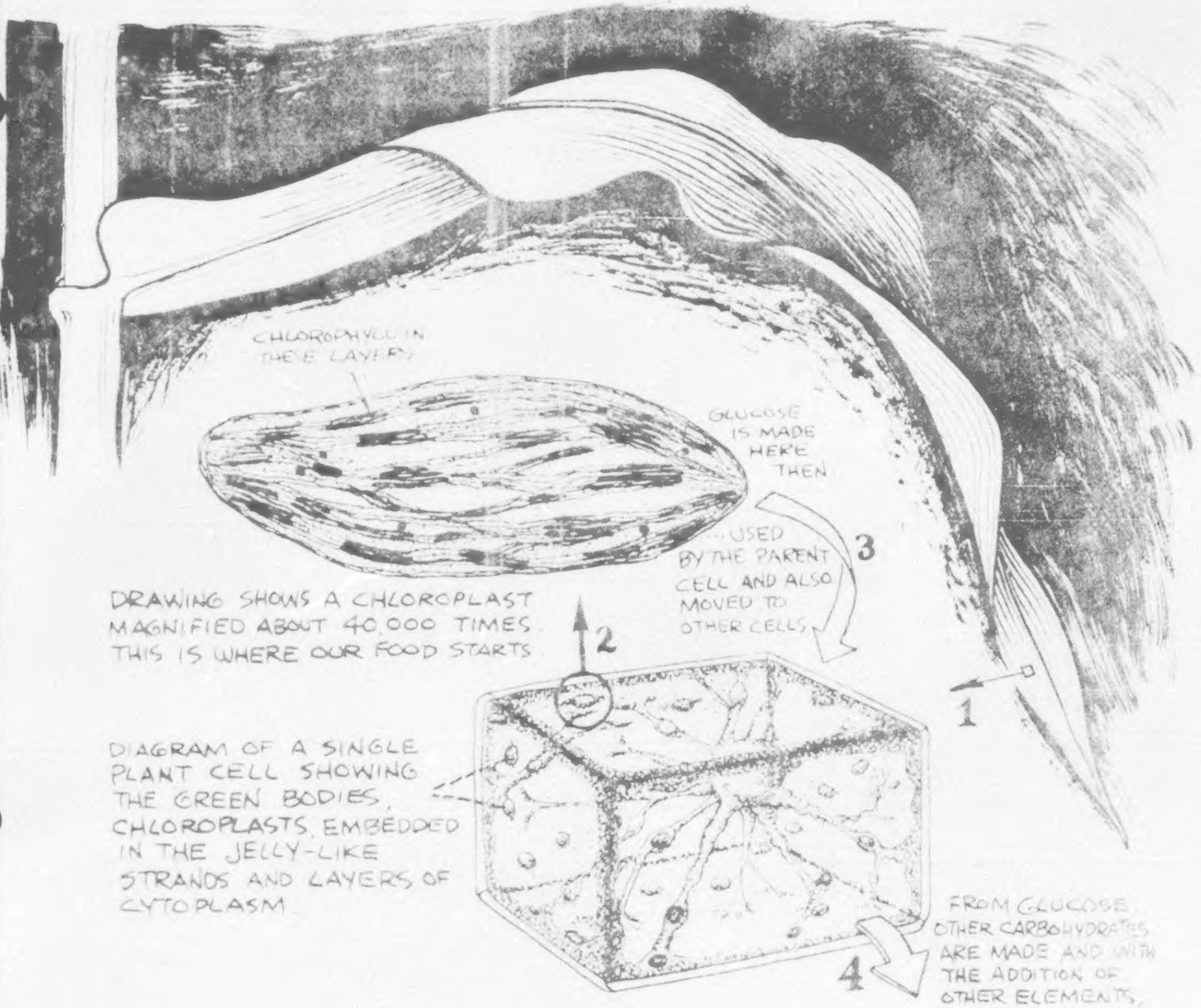
Life on earth depends mainly on 24 of the more than 90 chemical elements found on earth. Give THANKS that the root hairs of plants are able to extract these elements from dilute solutions in the ground, concentrate them, and enter them into the terrestrial biosphere. Root hairs, only one cell in size, make very intimate contact with the mineral-rich film of water surrounding the dirt granules. To constantly "mine" new areas, the short-lived root hairs are constantly formed in a zone near the growing tip of the root. Mineral extraction, along with photosynthesis and oxygen production, make animal life possible on this planet.



ELEMENTS TAKEN FROM THE SOIL INCLUDE: NITROGEN PHOSPHORUS, POTASSIUM, SULFUR, CALCIUM, IRON, MAGNESIUM, BORON, ZINC, COPPER, MANGANESE, CHLORINE, MOLYBDENUM.
SOIL PARTICLE WITH FILM OF WATER ON SURFACE
K
N
P
Fe
Ca
Cl
B
Zn
Mn
Mo
S
Mg

DIAGRAM SHOWING A MUCH ENLARGED ROOT HAIR CELL IN CONTACT WITH WATER BETWEEN AND ON THE SOIL PARTICLES.

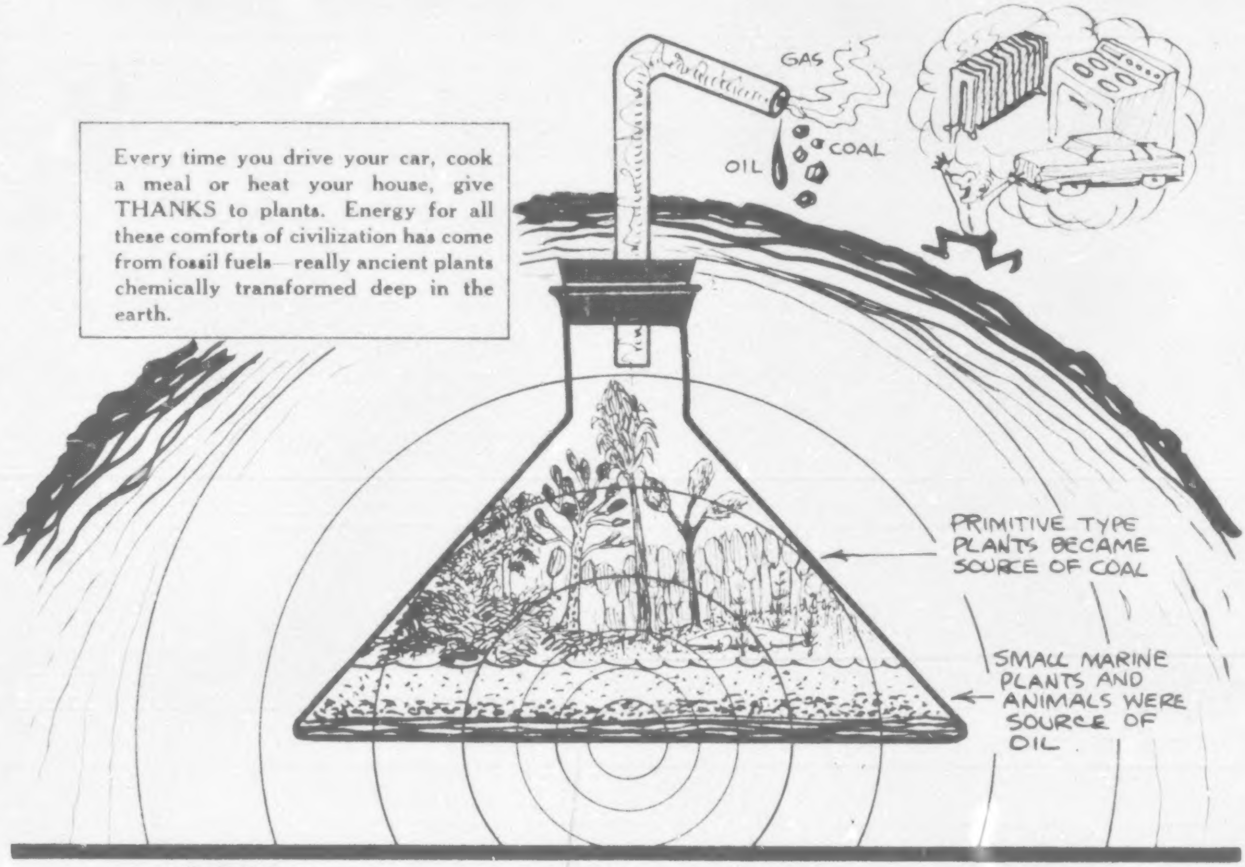
ELEMENTS, AS IONS IN SOLUTION, PASS INTO THE ROOT HAIR AND THEN BEGIN TO MOVE TO OTHER PARTS OF THE PLANT.

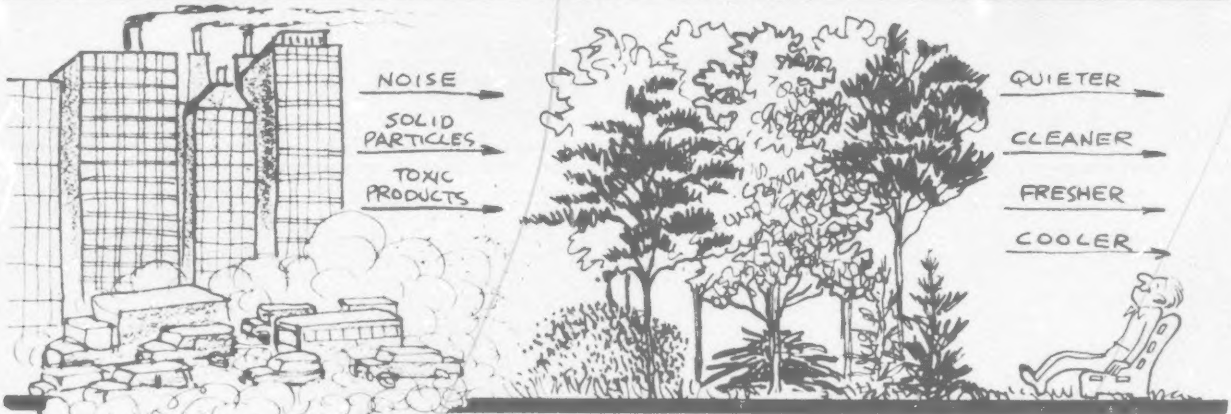

CHLOROPHYLL IN THESE LAYERS
GLUCOSE IS MADE HERE THEN
...USED BY THE PARENT CELL AND ALSO MOVED TO OTHER CELLS
3
DRAWING SHOWS A CHLOROPLAST MAGNIFIED ABOUT 40,000 TIMES. THIS IS WHERE OUR FOOD STARTS.
2
1
DIAGRAM OF A SINGLE PLANT CELL SHOWING THE GREEN BODIES, CHLOROPLASTS, EMBEDDED IN THE JELLY-LIKE STRANDS AND LAYERS OF CYTOPLASM.
4
FROM GLUCOSE, OTHER CARBOHYDRATES ARE MADE AND WITH THE ADDITION OF OTHER ELEMENTS, ALL THE PRODUCTS SHOWN SHOWERING MANKIND, ARE DERIVED.

All animal life should give THANKS to the green coloring matter in the leaves of plants. The green is chlorophyll — a combination of two greenish pigments. Chlorophyll has the ability to absorb energy from the sun, then behave as an enzyme to bring about the chemical reaction converting carbon dioxide and water to sugar (glucose). Starting with this basic substance, fat and carbohydrates are made. Proteins are formed by the addition of nitrogen, usually sulfur, and often phosphorus. These raw materials come from the soil.

Since animals lack the ability to start with elemental substances and build tissue, plants are absolutely vital to the existence of animal life. Vegetarians need no other food source but plants to live, and meat eaters — that includes most of us — eat the vegetarians. If all plants suddenly disappeared from earth, our planet would revert back to a lifeless object in the sky.

Every time you drive your car, cook a meal or heat your house, give THANKS to plants. Energy for all these comforts of civilization has come from fossil fuels— really ancient plants chemically transformed deep in the earth.

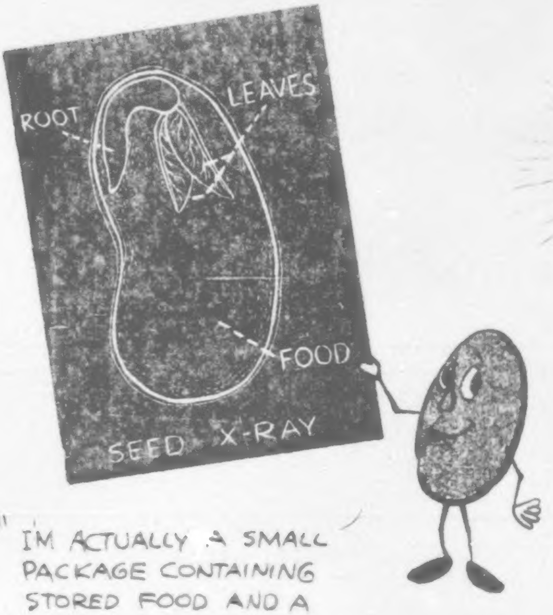

GAS
OIL
COAL
PRIMITIVE TYPE PLANTS BECAME SOURCE OF COAL
SMALL MARINE PLANTS AND ANIMALS WERE SOURCE OF OIL



Give THANKS that plants have uses beyond producing our food and fiber. In our present efforts to upgrade the quality of life, plants are playing an important role. Besides making our surroundings pleasant to look at, trees and grass can reduce air pollution by filtering out some of the solid particles, releasing oxygen, and cooling the earth by releasing water vapor. Even noise pollution is reduced by plants deflecting and absorbing sound.

A Wondrous Package

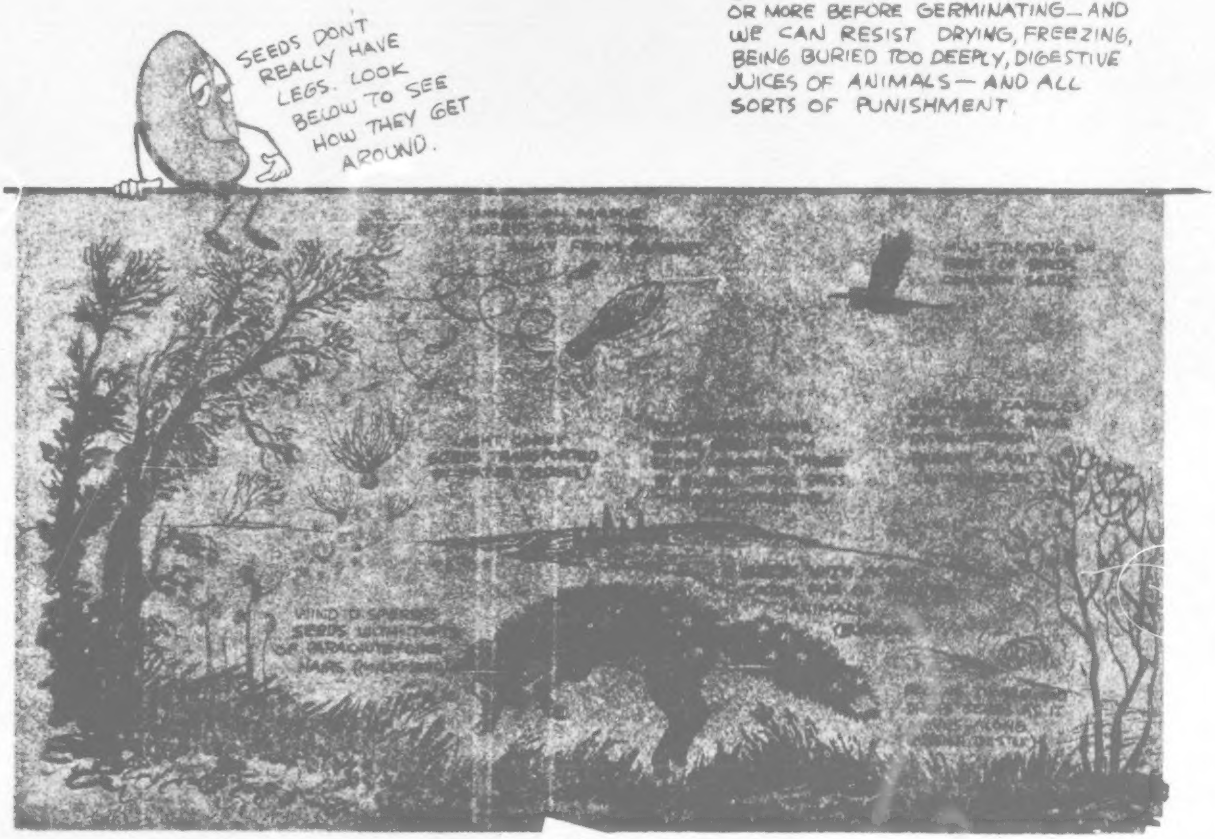
THAT'S ME - A SEED!

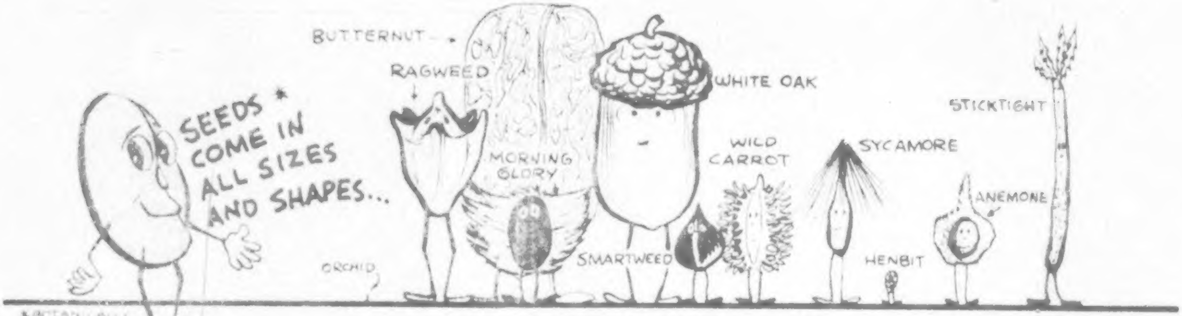


"I'M ACTUALLY A SMALL PACKAGE CONTAINING STORED FOOD AND A YOUNG PLANT."

BUT WHAT A PACKAGE!

SOME OF US CAN WAIT 50 YEARS OR MORE BEFORE GERMINATING—AND WE CAN RESIST DRYING, FREEZING, BEING BURIED TOO DEEPLY, DIGESTIVE JUICES OF ANIMALS—AND ALL SORTS OF PUNISHMENT.


SEEDS DON'T REALLY HAVE LEGS. LOOK BELOW TO SEE HOW THEY GET AROUND.



*BOTANICALLY SPEAKING SOME ARE "NUTS" AND "FRUITS"

...AND ALL KINDS OF PERSONALITIES!

LOCUST SEEDS ARE STUBBORN. THEY NEED A ROUGHING UP BEFORE THEY WILL GERMINATE.

THE SILVER MAPLE IS A SEED IN A HURRY. IT CAN GERMINATE RIGHT AFTER FALLING.

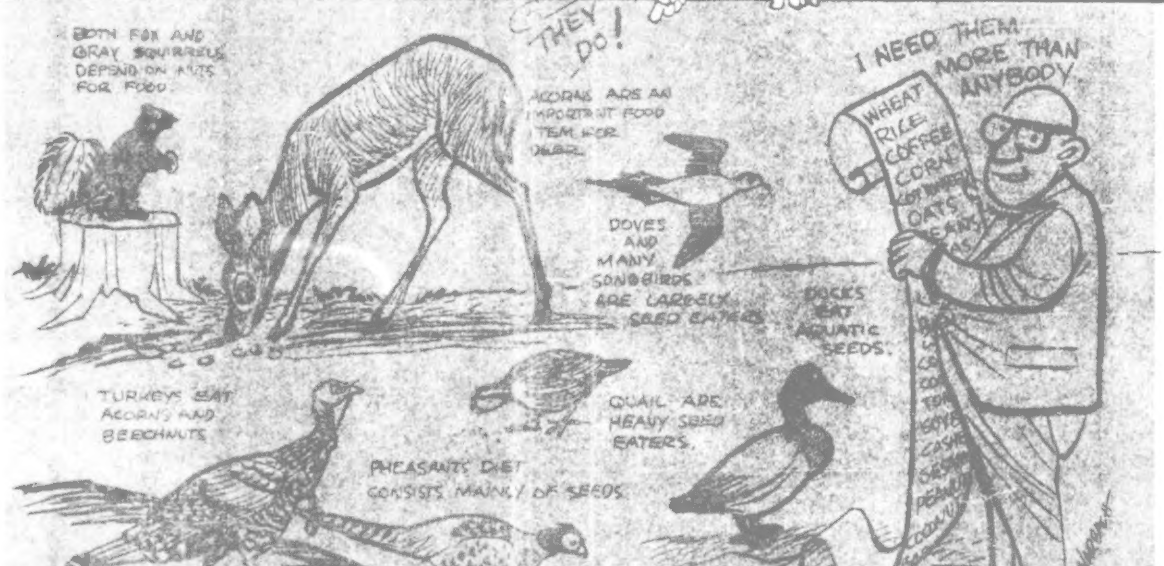
SEEDS OF TRILLIUM NEED TO BE COAXED. ROOT GROWTH STARTS AND CONTINUES ONLY WHEN SEEDS ARE CHILLED AND THEN WARMED. STEM GROWTH THEN NEEDS THE SAME SEQUENCE.

THE PEPPERGRASS NEEDS A PLACE IN THE SUN. LIGHT IS NECESSARY TO START GERMINATION.

JACK PINE SEED IS A HOMEBODY. IT TAKES A FIRE TO GET HIM TO LEAVE.

CATTAIL SEEDS LIKE IT UNDER WATER. THEY GERMINATE WHERE OXYGEN SUPPLY IS LOW.

WHO NEEDS SEEDS?



BOTH FOX AND GRAY SQUIRRELS DEPEND ON NUTS FOR FOOD.

ACORNS ARE AN IMPORTANT FOOD ITEM FOR DEER.

DOVES AND MANY SONGBIRDS ARE LARGELY SEED EATERS.

DUCKS EAT AQUATIC SEEDS.

TURKEYS EAT ACORNS AND BEECHNUTS

QUAIL ARE HEAVY SEED EATERS.

PHEASANTS DIET CONSISTS MAINLY OF SEEDS.

82

Soils

PHYSICAL HISTORY STUDY AREA - Grades: K-1

"DIG THAT DIRT" (SOILS) - 2 Hours

OBJECTIVES:

To make students aware that soils are different, supporting a variety of plants

MATERIALS NEEDED:

hand lense
stakes
hammer
jelly cups or baggies
spoons

I. "SOIL WITH SOUL": (20 minutes)

This activity is designed to involve students in using their senses to discover soil.

A. Close your eyes, lay on your tummy and feel the soil with your cheeks and plams of your hands. Take a handful of soil and let it drain through your fingers so you feel the texture and temperature of the soil. How does it feel?

B. Take a big handful of soil and rub it between your hands close to your ear and listen to the sound it makes. What sounds do you hear?

C. Now using only your nose, sniff the soil. Dig your hand in a couple inches and sniff the deeper soil. What do you smell?

D. Pass out hand lenses and examine the soil closely. What is in the soil? Insects? Stones? Leaves or needles? What is soil?

So far you have helped your students:

-- use their senses to become familiar and sensitive to soils

II. "STAKE OUT": (30 - 45 minutes)

This activity is designed to have students investigate what exists in the soils.

A. Stake out one large area for whole group or several smaller areas and break the students into several smaller groups. Pass out hand lenses --

B. Tell the students to examine the soil closely and look for:

- Living things
- Non-living things
- Colorful things
- Moving things
- Crawly things
- Things with legs
- Soft things
- Hard things
- Smooth things
- Rough things

C. Assign role-playing to each student or small groups. Have them act out each of the things they looked for.

III. "SAMPLE SOILS": (45 minutes)

This activity is designed to show students the variety of soils foundat Ah-Nei and plants that live in them.

A. Have large group broken into six groups.

B. Pass out cups and spoons to each group, each which has been labeled one of the below:

1. Under the trees
2. From the stream bed
3. Near a sage brush on a hill
4. From a cut-out near the stream
5. From a grassy area not in trees
6. From around the water tank

C. Tell each group where to go to gather the cupful of soil. Remind them to not disturb any plants if possible.

D. When group has gathered again with cups of soil, sit in a large circle. Dump the soil on white sheets of paper and have each group compare the color (dark or light) and where they got their samples. What plants live in these places where the samples are from?

E. Put samples back in cup and return soil to the same area it was taken.

So far you have helped your students:

-- see the difference in soils

-- realize that different soils support different plant life

-- focus on different living and non-living things in the water

IV. "DRAW THE DIRT": (20 minutes)

This wrap up activity allows students to express creativity in the natural surrounding.

A. Instruct students to find a twig on the ground suitable for drawing in the dirt or mud.

B. Tell them to pretend they are Indians and want to tell a story or leave a message for someone following them. Draw the story or message by pictures in the mud or dirt.

C. Share your picture with the group.

So far you have helped your students:

--focus on early man's use of soils

NATURAL CYCLES - SOILS - Grades: 2-3

STUDYING SOILS AT AH-NEI - (2½ hours)

OBJECTIVE:

1. To investigate the elements that form soil.

2. Extend to understanding of the role of parent rocks in soil formation.

3. To promote understanding that living things are inter-dependent with each other and their environment.

MATERIALS NEEDED:

Baggies
Colored paper (8" x 10")
Paste
Trowels
Sifters
Jelly cups and lids
Water
Tablespoon
Juice cans with both ends removed
Pencils
Watch with minute hands
Milk carton filled with rocks
Elastic bands
Paper
Sprinkling can

I. "EXPLORING ON THE GROUND: (30 minutes)

An awareness activity designed to introduce students to the many components of the soil.

A. "ANT ACTIVITIES": (30 minutes)

1. Students are instructed to lay on their stomachs and crawl on the ground as if they were ants (teacher included).

2. Look on the ground as you crawl, identifying different things you find in the soil. Encourage the students to talk about what they are discovering, as if they were "ants" coming upon obstacles to go around, or things to eat.

3. Each student should collect 2 things found in the soil, and bring them back to the large group.

4. In a large group, ask individuals to identify the things found in the soil.

B. As group, make a collage of the things you found. Use a rather small (8 x 10) piece of colored paper, and allow the students to paste their own objects on the paper. (Take the collage back to your classroom for display).

So far you have helped your students:

- discover the many elements found in the soil
- conceptualize the contribution of many elements in forming soil

II. INVESTIGATING SOIL:

Activities designed to explore the earth's crust, how it is formed and the processes involved.

A. HOW IS SOIL FORMED? (15 minutes)

1. Take your students on a dirt investigation. Show students how to use trowels and sifters for taking samples of the dirt.
2. In pairs, students collecting rocks, pebbles and dirt. (During this activity, students will discover that many things are found in the earth's crust).

Return to the large group.

QUESTIONS & DISCUSSION: (15 minutes)

1. What kinds of rocks did you find in your search? Where did they come from? (Example--sandstone rocks from larger outcroppings; sand particles from rocks.)
2. Have students rub 2 sandstone rocks together which will produce fine particles like soil. "How do you suppose rocks make soil when no one rubs them together? (rain, moving water, wind, plant roots, etc.)
3. Discuss how these things might work to form soil.
4. Introduce the words "humus" and "topsoil". Explain. Have students collect small samples of humus. Discuss the samples.

5. When plants and animals die, they return their parts to the soil as they decompose. Discuss decomposition. So far, what things have we found that are making "soil"?

6. The amounts of these things in the soil determines the "kinds" of plants that grow here. The kinds of plants determine the kinds of animals that live here. Why?

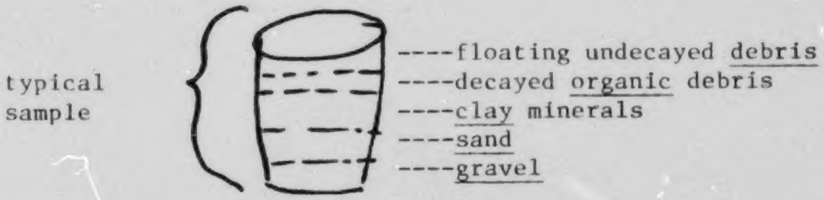
So far you have helped your students:

- recognize the "soil-makers"
- conceptualize the definitions of some words explaining soil

B. "SOIL SHAKERS" (30 minutes)

1. Students collect samples in their jelly cups, filling them with one tablespoon of soil. Add water until nearly full. Place the lid on securely. Shake the mixture thoroughly and place the cups on a level place.

2. Students lay on their stomachs in front of their cups, observing the settling process for 5 minutes.



3. Does the soil change color or have layers - What's in the soil?

4. "What things are on the bottom?" (rocks, large sand grains.)

5. "What floats on top?" (leaves, animal particles, etc.)

6. "If we think of parts of the earth in a cup, what happens when we get a heavy rain or snow melts?"

7. "How does the water work its way thru the earth?" (animal tunnels, plant roots, etc.)

8. "If plants were not growing here, and the soil was bare, what would happen to the topsoil?"
(The water would run away.)

This is known as erosion. Discuss.

> So far you have helped your students:
>
> -- identify layers in the soil
>
> -- be introduced to water's relationship to soil

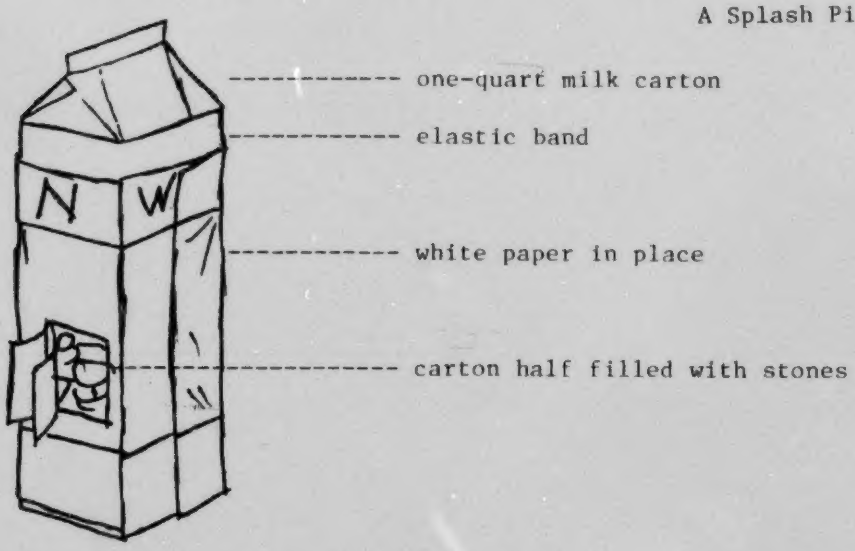
C. "WHERE HAS ALL THE SOIL GONE?" (30 minutes)

1. Before soil erosion can take place the soil particles must be loosened. Falling raindrops have considerable force. As they strike the ground surface they break up the soil and splash small particles into the air. These particles of soil can be easily carried away by run-off water. The amount of erosion can be measured.

2. Place your milk cartons in:

-- grassy area
-- bare soil area
-- shrub area

A Splash Pillar



3. Using a sprinkling can, stimulate rain by pouring on the soil around the carton. After your "rain", compare the soil splash marks showing on the white paper.

QUESTIONS AND DISCUSSION:

Which splash pillar had the most soil on it?

Which location suffered most from erosion? the least?

What factors influenced the amount of the splash?

4. Compile your findings for a report to the large group.

D. GIVING THE SOIL A TEST (15 minutes)

1. Determine how hard the soil is in different areas by trying to push a pencil into the ground.

"Where is the soil hardest?"
"Where is the soil softest?"

2. Determine how fast water soaks into different soils.

   a. Drive a juice can, with both ends removed, about 1" into the ground.

   b. Fill the can with water.

   c. Wait 2 minutes and measure how much water soaked into the soil.

   d. Repeat this experiment in several places.

"Where did the soil absorb the most water?"

Once again, we've found the importance of plant cover to the soil.

So far you have helped your students:

-- conceptualize the definition of erosion

-- understand the importance of vegetative cover in formation and continuation of good soil

-- conceptualize "absorption"

III. A COLOR CHAIN (15 minutes)

Concluding activity designed to re-emphasize the soil components identified in the investigation done by students:

A. Have everyone collect small pieces of things in the soil.

B. Using a strip of colored paper, attach the pieces, overlapping to form a color chain. Begin with the lightest and end up with the darkest.

C. Talk about the relationship of each piece to the next one in the chain.

So far you have helped your students:

- use creative expression in the out-of-door environment
- conceptualize "relationship"

NATURAL CYCLES - SOILS - Grades: 4-5

STUDYING SOILS AT AH-NEI - 2½ hours

OBJECTIVES:

A. To investigate the elements that form soil.

B. To extend understanding of the role of parent rocks in soil formation.

C. To promote understanding that living things are interdependent with each other and their environment.

MATERIALS NEEDED:

Paper
Pencils
Flip chart
Magic markers
Soil thermometers
Regular thermometers
Hand lenses
Soil testing kit
Soil Data Tables and questions
Solo search sheets

I. COMMUNICATING WITH NATURE (30 minutes)

An awareness activity to make students feel "at home" and relaxed in their out-of-door environment.

A. Colors are an exciting part of anyone's environment. They add a great deal of enjoyment to our lives that we are really unaware of. They help to tell us what season it is, what the condition of our environment is, in developing our communications with others and our own self image.

Write down the following:

1. What is your favorite color?

2. How does it feel? taste? smell? sound?

3. What can you see around you right now that is your favorite color?

4. What do these colors do for the natural objects you identified?

5. Let's write down your favorite colors on this flip chart.

   a. How does ____________make you feel? (Do everyone's favorite color)

6. a. What color is the wind?
   b. What is the sound of a large pine tree?
   c. How does the mountain feel?
   d. What does (rain or sunshine) smell like?
   e. What does mountain air taste like?

So far you have helped your students:

-- use creative expression in the out-of-door environment

-- recognize some personal feelings about the environment

II. SOILS IN A MINI CLIMATE (30 minutes)

Activities to explore and investigate soil at Ah-Nei and its interrelationship with the environment.

A. Taking the earth's temperature.

1. In groups of 3, temperature readings will be taken at different heights above the ground surface; record the following: (Let the thermometer settle for 3 minutes before recording your reading; do not move the thermometer when reading it.)

   .5 feet above the ground in an open, grassy area -

   .resting on a rock in the sun or in the open -

   .in the crook of a tree -

   .on the ground in the shade -

   .on the ground in an open, grassy area -

2. Return to the large group.

3. Record your findings on a flip chart.

QUESTIONS AND DISCUSSION:

1. What were the variables that affected these temperatures?

2. What were the temperature differences?..similiarities?

3. What would change these temperatures?

4. Would you say there is a temperature pattern? Explain.

5. How would temperatures vary in the day?

6. What temperature differences might we find beneath the soil or surface?

A. Taking the earth's temperature (continued)

4. Temperatures below the surface:

In the same groups of 3, make holes in the ground using spikes or pencils at the same spot you recorded above the ground. Insert the thermometers and allow settlement for 3 minutes before recording the following.

.Under the 5 feet -

.at the base of the rock, but not touching -

.at the base of the tree, but not touching -

.below the surface in the shade -

.below the surface in the open, grassy area -

5. Return to the large group;

6. Record findings on the flip chart.

QUESTIONS AND DISCUSSION:

1. What temperature difference did you find among the recordings under the surface?

2. What were the variables in these recordings?

3. Would the temperature vary if you went deeper?

4. What temperature differences did you find between the recording on top of the surface and that taken below?

5. Did the same variable affect both temperatures?

WHAT CLIMATIC THINGS AFFECT THE TEMPERATURES ON THE SURFACE OR ABOVE? (Light, wind, moisture, soils)

So far you have helped your students:

- understand variations in temperature according to outside influences
- conceptualize soil temperature

B. SOIL SKILLS (30 minutes)

In the next investigations, we will attempt to develop some skills and apply them to collecting and interpreting dataabout the soil environment.

1. Describe in writing your own description of soil. Keep this description for your own reference at the end of the session.
2. Predict what things you will find in the top few inches of this forest floor. List your predictions:
3. Stake out an area 2 or 3 feet square on the forest floor and sift through the top 3 inches of the soil, recording the evidence of plant and animals you observe.

Name or Description of Item in the Soil	Quantity	Possible Effect on Soil

4. Discuss the following three terms, used to describe organic matter at the top of the soil - litter, duff, humus. From your study above, complete the following chart:

Term and definition	Describe the feel	List the identifiable parts of plants and animals you found
Litter (identifiable dead things on surface)		
Duff (partially decomposed organic matter - compacted)		
Humus (almost completely decomposed non-identifiable organic matter)	95	

QUESTIONS AND DISCUSSION:

1. What did you find?
2. When would you expect to find more organisms? different organisms?
3. How do the organisms you found benefit the soil?
4. What are some reasons for odors in the soil?

C. DEVELOPING THE SKILLS TO COLLECT SOIL DATA (45 minutes)

A cut in the soil should be made to examine layers. When there is no excavation at the site, a v/shaped cut made with a shovel to a depth of 1 to 2 feet should be sufficient.

QUESTIONS AND DISCUSSION:

1. Move group around to the soil profile.
2. What can we see as we look at this cross-section or profile of soil?
3. What are some things that would be important to find out about it? (accept all comments)

   The observable characteristics of color, texture, structure, temperature and the acidity or alkalinity (pH) of a soil are indications of soil conditions important to plants in the area.

   We are going to collect and record some of this information. We will stay together as a group to develop skills in collecting soil data.

C. 1. In a large group, discuss the following things while examining your soil cut: (allow different students to help you.)

   a. Soil layers

      Mark where the soil changes color and looks. Many soils have 3 major layers or horizons, i.e. top soil, subsoil and parent material; because soil formation has many variables you may find more or less. (Measure and record the depth of each major layer).

b. Color

Describe and record the texture of each major layer. (Have participants pick their own description of color.)

c. Texture (How the soil feels)

Determine and record the texture of each major layer.

Texture is determined by feel (push and rub moistened sample between thumb and forefinger. Spit on sample to moisten.)

If it feels gritty ....sand
If it feels smooth & slick, not very sticky..............................silt
If it feels smooth, plastic, very sticky..............................clay

d. Structure (How the soil is put together)
Determine the structure of each major layer. Carefully break apart a shovelful of soil from each layer and match its characteristics with one of the structure words on the lab sheet.

e. Temperature

Determine and record the temperature of each layer. Plant's growth depends upon soil temperatures during the growing season. Find out your growing season before lesson. Compare with earlier soil temperatures taken.

f. pH (acidity or alkalinity) Discuss pH and soil.

Determine and record the pH of each major layer, using the soil testing kit. Plants need many soil nutrients to grow well. The degree of pH affects how plants grow.

2. Use the soil data we have collected and these tables to answer the following questions:

a. Effect of Soil Depth on Plant Growth and Water Storage

Deep Soil (over 42")	Excellent water storage & plant growth
Mod. Deep Soil (20"-42")	Good water storage and plant growth
Shallow Soil (20" & under)	Poor water storage and plant growth

The potential of my soil for water storage and plant growth is:

Excellent_____ Good______ Poor______

Why?____

b.

Effect of Texture on Soil	Water Holding Capacity	Looseness of Soil
Sand	Poor	Good
Silt	Good to Excellent	Good
Clay	High (Plants can't use it in clay.)	Poor

My Soil Texture	Soil Water Holding Capacity	Looseness
Topsoil (A)		
Subsoil (B)		

c. pH Investigation

pH RANGE OF PLANTS

pH 1	4.5	6.5	7	8.5	14
(1 to [illegible].5 is too acid for most plants)		(Most plants do best here)		(8.5 to 14 is too alkaline for most plants)	

EXAMPLE OF PLANTS IN pH RANGE:

pH 4.0 - 5.0: rhododendrons, camellias, azaleas, blueberries, fern, spruce
pH 5.0 - 6.0: pines, firs, holly, daphne, spruce, oaks, birch, willow, rhododendron
pH 6.0 - 7.0: maple, mountain ash, pansy, asters, peaches, carrots, lettuce, pines, firs
pH 7.0 - 8.0: beech, mock orange, asparagus, sagebrush

Using the pH Ranges you recorded and the table, "Examples of Plants in pH Range," complete the following chart:

Some Plants That Could Grow Here Based on the pH and Chart	Some Plants Actually Observed Growing Here

Soil Temperature

Soil Temperature	Conditions During Growing Season
Less than 40°F	No growth, soil bacteria and fungi not very active
40°F to 65°F	Some growth
65°F to 70°F	Fastest growth
70°F to 85°F	Some growth
Above 85°F	No growth

What does the soil temperature chart tell you about soil here?

So far you have helped your students:

-- Develop some skills for investigating soils.

-- Conceptualize factors affecting vegetative growth in the area.

III. SOLO SEARCH: (15 minutes)

An activity to draw together feelings about the environment we are investigating.

1. By yourself go into the forest and bring back the following things. Enjoy yourself as you work! (Take 10 minutes)

- Evidence of man
- Evidence of an animal
- Evidence of reproduction
- Something you think is good
- Something you think is bad
- Something that you feel describes your relationship to the environment.

Discuss: (At a neat place.)

So far you have helped your students:

- Explore impact - both natural and man-made - on the area.

SOIL COMPACTION AND WATER ABSORPTION

Tramp, tramp, tramp. You walk along a path or across a lawn or field. Every step you take may affect the soil and plants growing in it -- perhaps for years to come.

How can your footsteps be so important? Let's find out. Fill 2 jars with soil. In one, press the soil down firmly with your fingers. Then pour equal amounts of water, about 2 ounces in each jar. How long does it take for the water to reach the bottom of each jar? By pressing the soil down in one jar, you squeezed the particles of soil together. This closed most of the tiny air spaces that were there before. This "pressed" soil is called "compacted" soil. This condition affects the plants that grow or can grow in the soil, which in turn affects the amount of animal life that the land can support.

In the natural environment, compacted soil is slowly loosened by the roots of plants and by some animals, such as earthworms.

An important part of investigations of most environments is a study of the soil, its compaction and its water absorption. The amount of water absorption in soil is determined to some extent by the degree of compaction, as was seen with the water and soil in the jars. The compaction of soil differs in various places due to various factors, both natural and man-made. Some of the factors which affect soil compaction are: soil type, use of the area by man and other animals, plant cover, and exposure to weathering and erosion.

Soil Compaction Gauge - an instrument to measure relative soil compaction.

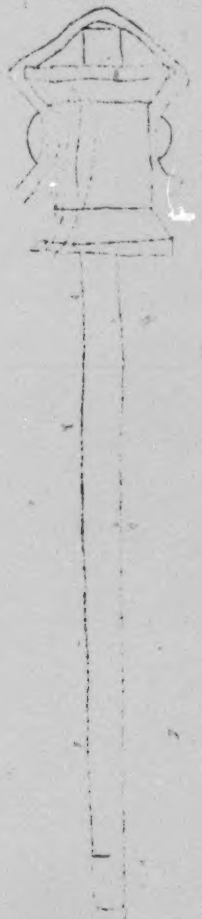
Materials:

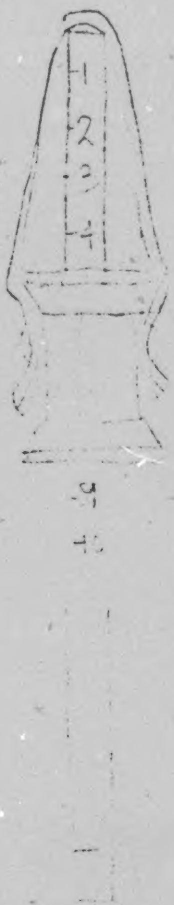
#5 juice can
pencil & paper
12" ruler
container of water
watch or clock
2 thumbtacks
½" rubberband (wide)
empty spool
9" length of dowel (fits in spool)

To make a simple soil compaction gauge, pupils will need to do the following: First, sharpen one end of the dowel with a knife or in a pencil sharpener. With a ruler, measure one inch from the point and mark a dark line. Then measure from the unsharpened end of the dowel and mark off ten lines, each a half inch apart. Number these lines starting with number 1 near the unsharpened end. Fasten a wide rubber band to the top of the spool with a thumbtack on each side. The soil compaction gauge is now ready to use outdoors. (See illustration on the next page.) Slip the dowel onto the spool and pull down on the spool, forcing the point of the dowel into the soil up to the dark line. When the pointed end is in this far, read the number at the top edge of the spool. This number is the soil compaction reading for that location. Try other places. Where is the soil most compacted? Least? Different plants? Size of same plants different?

To begin examinations of water absorption, pick a sample location. Press the gauge into the soil up to the bottom one-inch mark. Immediately take a reading at the top edge of the spool. This is the soil compaction number for that location. Then take a #5 tin can with both ends removed. Force it into the soil around the spot where the compaction reading was taken. Quickly pour one quart of water into the can and keep a record of the time that it takes the water to soak into the soil. With a plastic ruler, it is possible to also keep a record of the depth of the water in the can at regular intervals. Repeat the process in other locations and compare the results. Record important information about the soil, plant cover, evidence of erosion, and other factors. Discuss impact on vegetative cover.

Develop your own method of recording data in your group. What does it tell us?





NATURAL CYCLES - ANIMALS - Grades: K-1

"THE NATURAL NEIGHBORHOOD" - 2 Hours

OBJECTIVES:

1. To have students examine small animal homes in the area.

2. To have students experience role-playing being an animal and building a home for themselves.

3. To be aware of the delicacy of the homes.

MATERIALS NEEDED:

Stakes (pencils)
String
Hand lenses
Large stamp

Paper
Crayons
Scissors
Poster board

I. "THE FUNNIEST HOMES AROUND US": (45 minutes)

This is an awareness activity designed to show students small types of homes built by different types of animals and insects.

1. Point out one tree to the students and explain that the tree has a home on that hill. The tree is also used as a home for many animals. Can you name some animals that live in trees?

2. Stake out a small area - 2 ft. square for each pair of students or assign a rock, a log, a stump, a tree, or a bush to be studied with the hand lenses. Ask the students to look carefully without disturbing the homes. Remember, you are like giants to the insects and other small animals. Watch out for spider homes!

3. Students may get in big group and tour all the homes they found, having each pair of students tell about it and what they know about who lives there.

So far you have helped your students:

-- Be aware of the tiniest of animals and their homes.

-- Explore the smallest component in the environment.

103

"HOMES ON A LOG": (45 minutes)

This is an inventory activity designed to show students that animals and plants may live together in one house.

1. Lead students to the stump or log covered with mosses, lichen, plant outcroppings. Find insects or evidence of animal inhabitance in or near the log. (droppings, fur, feathers, chewed wood, etc.)

2. Ask students to look for signs of life everywhere on the log.

3. Have students name all different animals that could use the log as a home.

   Emphasize that this is a home and not to be disturbed - just like your home should not be disturbed.

4. When the students find evidence of animals, ask each to take turns and role-play being each different animal.

5. Ask students to color a picture of each animal whose home they have visited. Cut them out and make a big collage on poster board for the classroom.

WRAP-UP

"MY NAME IS...": (30 minutes)

A wrap-up activity designed to allow students to experience the act of building a home using the materials found in the area.

Allow 2-3 minutes for each student.

1. Instruct students to think for a few moments about all the animal homes they have seen today and about their construction.

2. Ask each student to silently pantomine building a home and have other students guess what animal he is.

So far you have helped your students:

- -- Realize what materials are used to build a home for wild animals.
- -- Experience the actual building of a home as if he were a wild animal.

NATURAL CYCLES - ANIMAL HABITAT - Grades: 2-3

INVESTIGATING ANIMAL HABITAT AT AH-NEI - (2½ hours)

OBJECTIVE:

To provide a field experience that will allow students to discover and investigate the importance of animal habitat.

MATERIALS NEEDED:

- Hula hoops
- Hand lenses
- Baggies
- 10' lengths of string
- Stakes
- Paper
- Pencils
- Charcoal
- Flip chart
- Magic markers
- 2" wide strips of cardboard - 1' long
- Used vegetable cans
- Plaster of Paris
- Paper clips

AN AH-NEI SAFARI

I. A "GRASSY JUNGLE":

Awareness activities to stimulate students' interest in animal habitat.

A. Micro-Crawl (20 minutes)

1. Each student stretches a 10' string between two sticks on any site they may select.
2. The student inches along on his belly looking at the world along the string only thru his magnifying glass.
3. Share experiences:

   -- the funniest thing
   -- the meanest thing
   -- the fuzziest thing
   -- etc

B. A Racoon's Life (10 minutes)

1. Tell students you would like them to explore a designated area ---- only you would like for them to do it as a Racoon.

2. They should go in teams of 2 and look for:

   - a place to live
   - a place to hibernate
   - some food
   - a place to escape predators

So far you have helped your students:

- focus on a mini-habitat
- identify basic elements in a habitat

3. Reassemble and share experiences.

II. THE HUNT:

Activities designed to inventory and understand interrelationship in animals and their habitat.

A. ANIMAL EVIDENCE SURVEY: (30 minutes)

1. Divide into pairs. Throw your hoop 5 times in the area. Try to choose 5 different types of areas. Find animal evidence within the hoops, looking for examples of homes, food, migration or movement and predator-prey. Make an attempt to identify the type of animal leaving the evidence.

QUESTIONS AND DISCUSSION:

1. What kind of evidence did you find?
2. Does anything surprise you about the evidence you found?
3. Can you determine from any of the evidence, the type of food consummed by that particular animal?

B. RATING THE AREA AS AN ANIMAL: (30 minutes)

In the same pairs, choose one of the animals you identified. Pretending to be that animal further investigate this area for signs of that animal and attempt to answer the following questions:

1. Look for the following and rate the area for your needs.

a. general habitat
b. winter and summer food supply
c. evidence of who might be your predator

2. Where will you locate your home, nest, etc?

   a. Why?
   b. What does your home look like?

3. How and why are you as animals of your kind important in this environment?

4. Prepare your findings for a report to the large group.

5. Draw a picture of your home and yourself.

C. ANIMAL CHARADES: (30 minutes)

1. Return to the group.

2. Each team role-plays (pretends to be) their animal while the large group guesses what they are.

3. When your identity is guessed, present your report to the group.

So far you have helped your students:

-- discover the types of animals in this eco-system

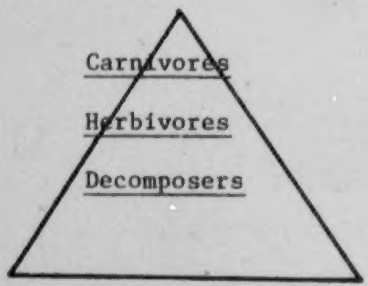
-- experience the needs of animals to survive in their habitat

D. A FOOD CHAIN: (30 minutes)

1. On the flip chart, list the animals for which you found evidence during the investigations.

2. Study the list.
   --"Who is related to who? Why? How?"

3. Can we build a food pyramid from this list? (Draw on the flip chart with students' help) Who eats Who? (fill in the pyramid)



QUESTIONS AND DISCUSSION:

1. What would happen if we removed one of them?
2. How would the area change?
3. Create a story about the change.
4. Dramatize the story.

So far you have helped your students:

- -- identify important relationships between animals and their environment
- -- become aware of the importance of every animal in its eco-system

III. TRACKING ANIMALS: (30 minutes)

A concluding activity designed to involve students with animals in their habitat.

A. PLASTER CASTS OF IDENTIFIED ANIMAL TRACKS:

1. Fasten strip of cardboard into a circular collar using the paper clips or some other means to fasten the two ends together. Press this collar down around the track you wish to preserve.

2. Put powdered plaster of Paris into vegetable can and add water, a little at a time, stirring with a stick. When you have sufficient amount of batter the consistency of thick pudding pour into track, making sure that no air bubbles are left and that the mixture trickles into every corner of the track.

3. Let cast dry. Carefully remove collar and lift out the cast. Let dry for 1 or 2 more hours. Wash away all bits of soil and stones that cling to the cast and you will have a negative of the original track.

4. If the air is very cold, casts can be made in snow by spraying the track with water from an atomizer. This will harden the track. As a further precaution against melting, mix some snow into the wet plaster. This will be a "negative" cast.

To make a "positive" cast, first coat the negative cast with vaseline, then set it in the paper collar and pour plaster mixture over it until the protruding paw mark is covered.

B. BACK IN THE CLASSROOM:

1. To make a positive, grease the negative with vaseline, then press it into a second batch of soft plaster of Paris. When dried, lift the cast out, and you will have a plaster of Paris copy of the original track. One may then paint this copy to make it appear more realistic.

C. IDENTIFY AND DISCUSS YOUR TRACKS:

So far you have helped your students:

-- understand that living things are adapted by structure and function to their environment

-- use creative expression in the out-of-door environment

Hog-nosed Skunk (foreground) and Striped Skunk

Red Fox

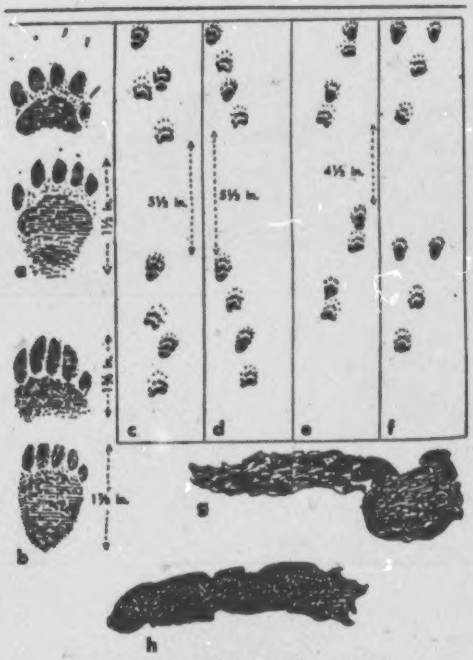


Fig. 37 Tracks and droppings of striped skunks.

a. Tracks of *Mephitis* sp., in mud
b. Tracks of *Conepatus*, hog-nosed skunk, in dust; in both cases the top figure represents the front foot (Big Bend Natl. Park, Tex.).
c, d, e, f. Various gaits of the common skunk; note variations in placement of hind feet, which can be recognized by the heel.
g. Scat of common skunk. h. Scat of hog-nosed skunk.

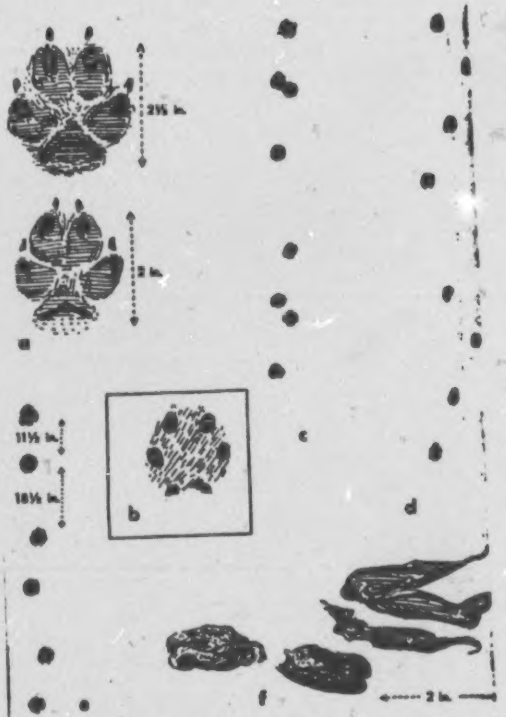
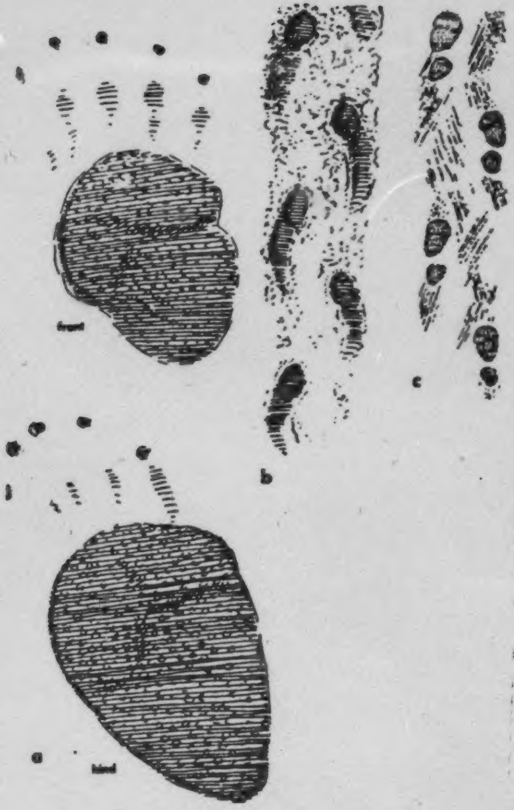


Fig. 49 Red fox tracks and scats.

a. Tracks in mud. Upper, front; lower, hind (Alaska Peninsula).
b. Track on firm sand (Alaska). c. Loping gait.
d. Running, with hind tracks out in front.
e. Walking gait. f. Scats.

Porcupine

Cottontail



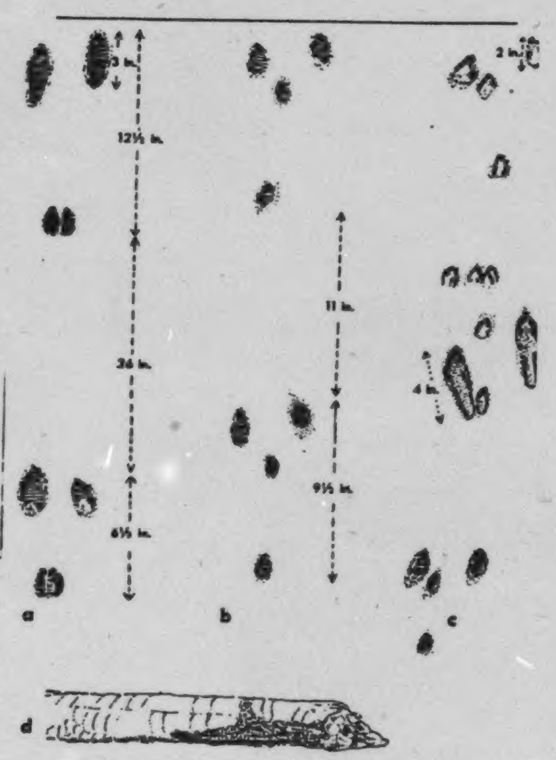


Fig. 126 Cottontail tracks in ½ in. of snow (Washington, D.C.).

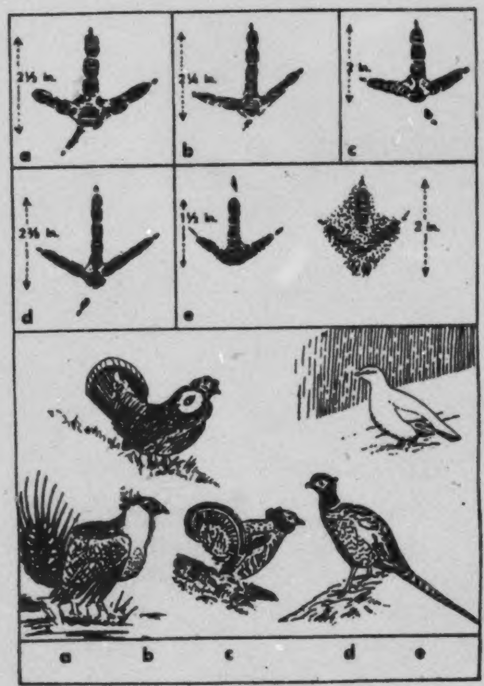


Fig. 171 Tracks of grouse.

a. Sage grouse, in mud. b. Blue grouse, in snow.
c. Ruffed grouse, in mud. d. Male Chinese pheasant, in mud.
e. Rock ptarmigan: left, in mud; right, in snow, when toe feathers are well grown.

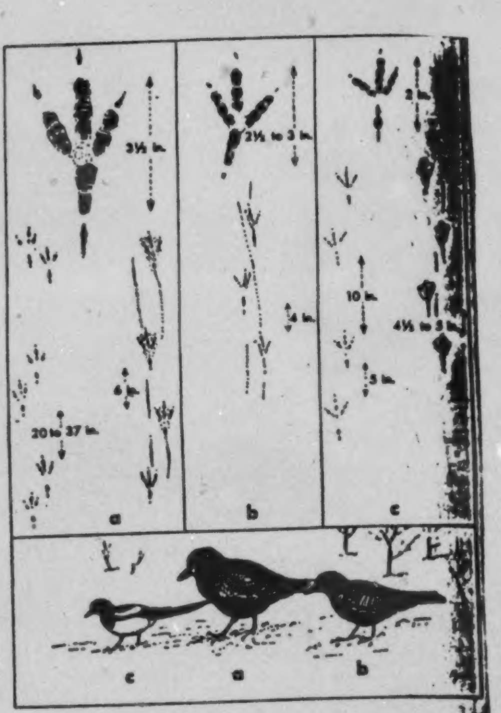

3½ in.
20 to 37 in.
6 in.
a
2½ to 3 in.
4 in.
b
2 in.
10 in.
4½ to 5 in.
5 in.
c
c
a
b

Fig. 176 Tracks of raven, crow, and magpie.

a. Raven track, in sand (Aleutians). Left tracks, hopping to take flight; right, walking in snow (both from Wyoming).
b. Crow track in mud (Okla.). Below, walking gait.
c. Magpie track in snow (Wyo.). Left, hopping trail; right, walking in deeper snow.

Snowshoe Rabbit

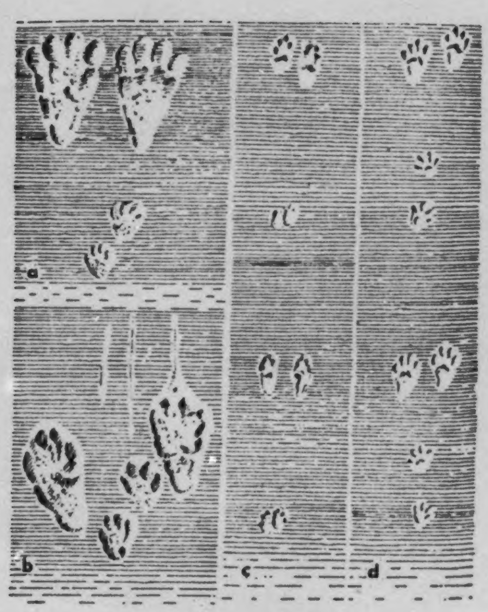


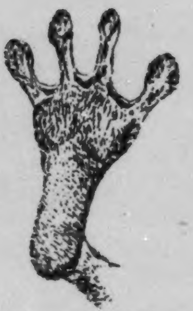
Fig. 125 Tracks of snowshoe rabbit in snow.

a. Track of Washington hare, *Lepus washingtoni*, slow hopping, in snow. Length of track pattern, about 11 in.; hops, about 14 in. (Olympic Mts., Wash.).

b. Snowshoe rabbit of Rocky Mts., slow hopping. Length of track pattern about 10 in.; hops, about 10 in. (Wyo.).

c. Rocky Mt. snowshoe rabbit speeding. Track patterns about 24 in.; leaps, 38 to 67 in. (Wyo.).

d. Washington hare speeding. Track patterns 20 to 22 in.; leap, 66 in. (Olympic Mts.).



Snowshoe Rabbit's "snowshoe." Spread toes of the right hind foot (Hudson Bay, 1914)

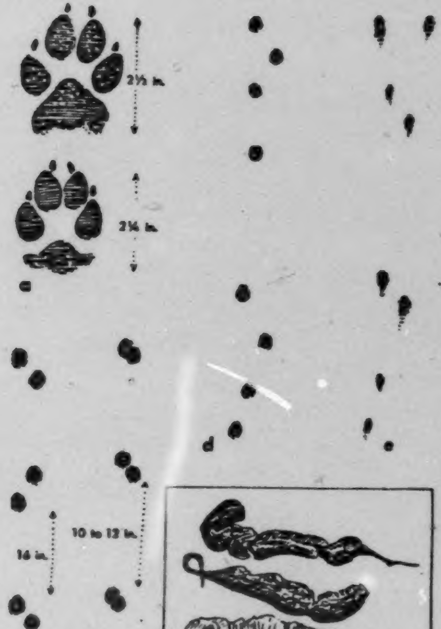


Fig. 46 Coyote tracks and scats.
a. Tracks in mud. Upper, front; lower, hind (Okla.).
b and c. Easy lope. d and e. Gallop.
f. Two types of scats.

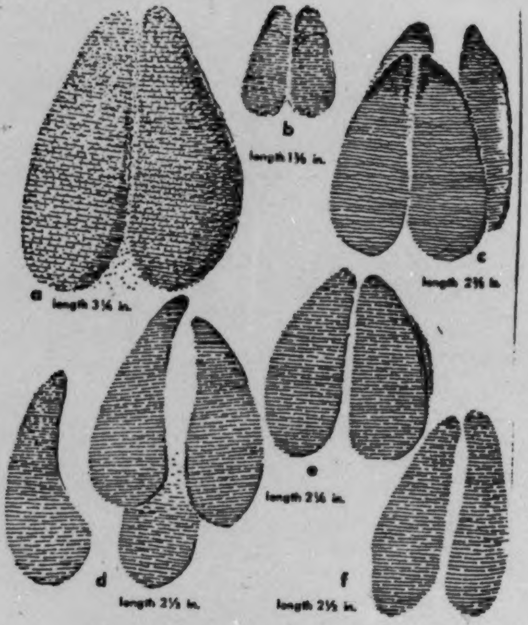

a
length 3¼ in.
b
length 1⅜ in.
c
length 2⅜ in.
d
length 2½ in.
e
length 2⅛ in.
f
length 2½ in.

Fig. 136 Mule deer tracks, about ⅗ natural size.
a. Adult male, in dust (Grand Teton Natl. Park, Wyo.).
b. Fawn (Yellowstone Natl. Park, July 16, 1929).
c. Adult female, in mud (Grand Teton Natl. Park, Wyo.).
d, e, f. Tracks in dust (northern Nev.).

114

Prairie Dog

Ground squirrels.

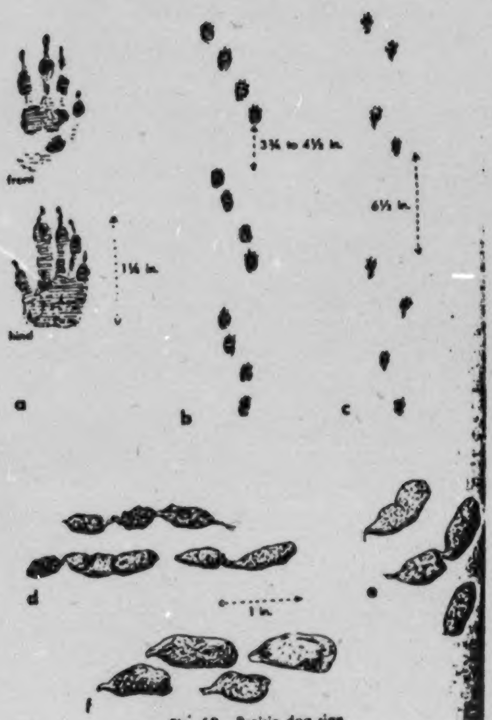
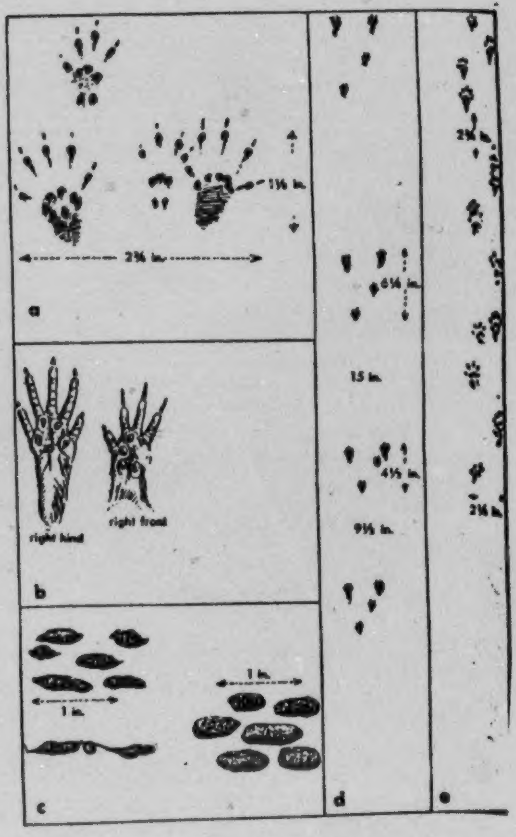


Fig. 69 Prairie dog sign.

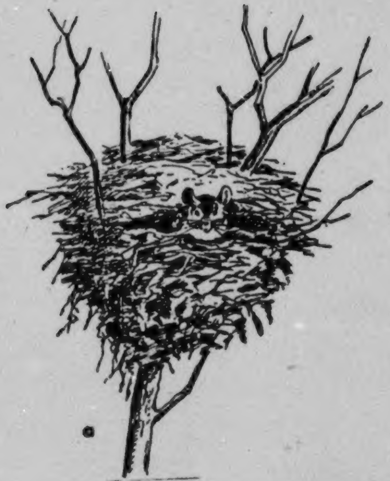
a. Tracks of black-tailed prairie dog (No. Dak.).
b and c. Running track patterns (No. Dak.).
d and e. Black-tailed prairie dog scats, one showing less common in which pellets are connected (d, No. Dak.; e, Wichita Mts., O
f. White-tailed prairie dog scats (southern Wyo.)



a. Track of Uinta ground squirrel, *Citellus armatus* (Wyo.).
b. Foot structure of Franklin ground squirrel, *Citellus franklini* (Ontario).
c. Droppings of Uinta ground squirrel at left (lower: a less common form, from more succulent food) and the larger rock squirrel, *Citellus variegatus*, at right.
d. Running pattern in snow, Uinta ground squirrel.
e. Walking pattern on mud, Uinta ground squirrel.

115

Chipmunk



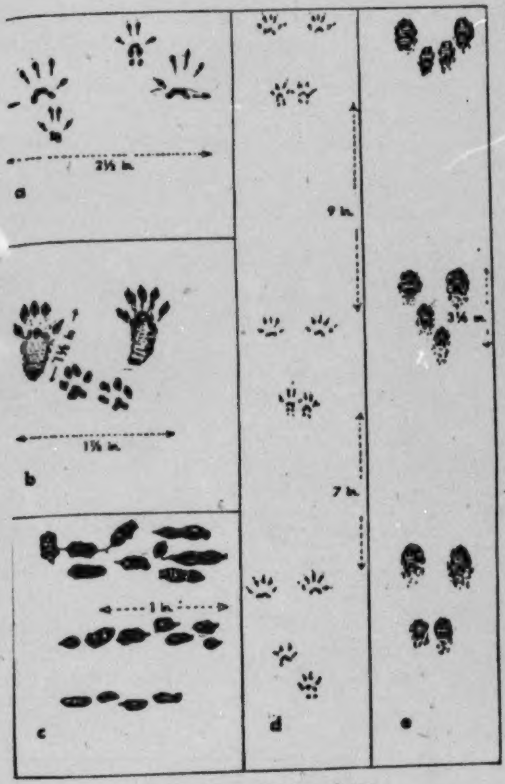


Fig. 72 Chipmunk tracks and scats.

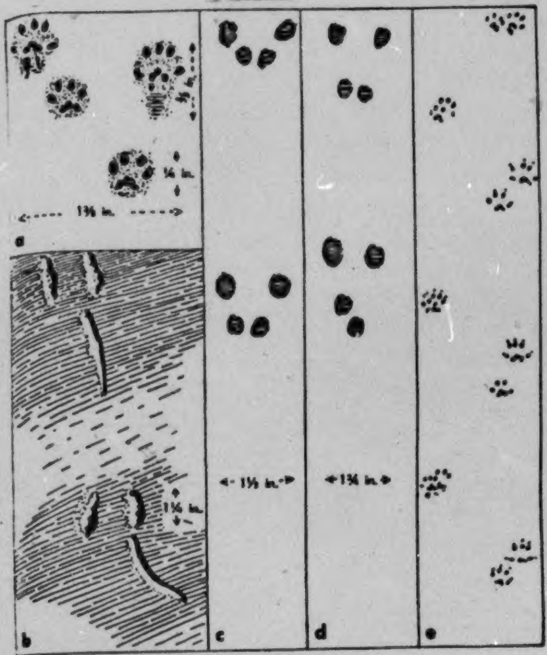
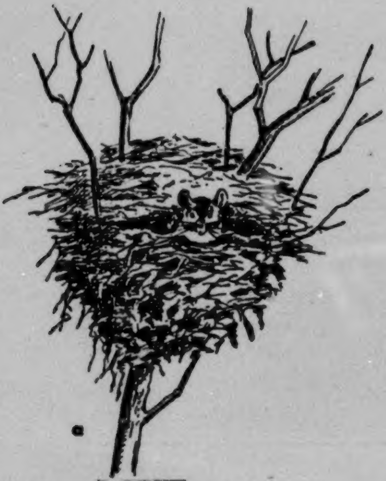


Fig. 101 White-footed mouse tracks, from Wyoming.

a. Running tracks in dust, about natural size. Front track (four-toed) ¼ in.-long and wide.
b. In light snow, with tail marks. Hind and front feet make one elongated print, about 1¼ in. long. Leaps measured 3 to 9 in.
c. On very light layer of snow. Leaps 5 to 8 in.
d. On firm snow. Leaps 2 to 3 in.
e. Slow run in wet mud. Individual tracks about 5/16 in. wide.

116

Chipmunk



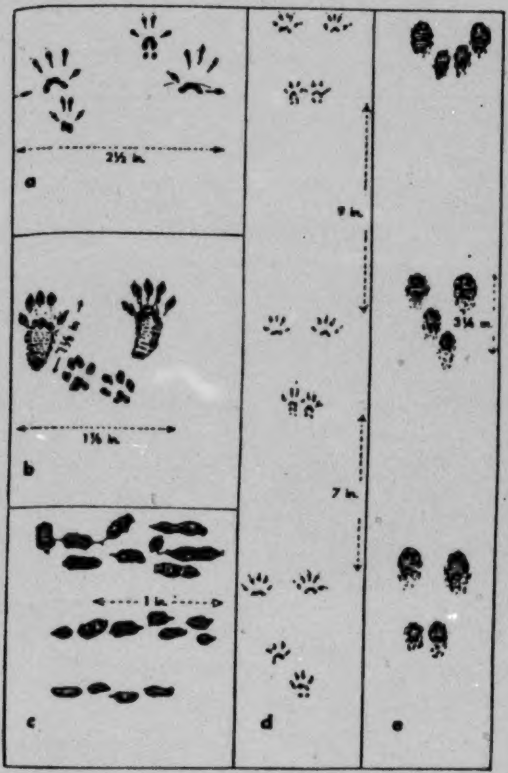


Fig. 72 Chipmunk tracks and scats.

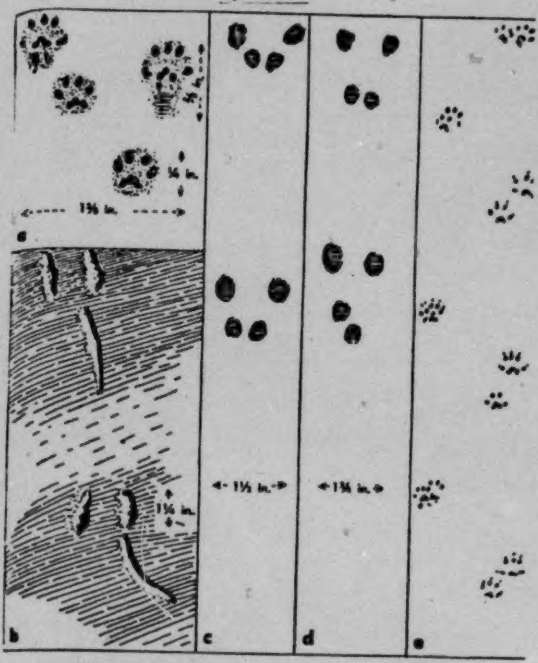


Fig. 101 White-footed mouse tracks, from Wyoming.

a. Running tracks in dust, about natural size. Front track (four-toed) ¼ in.-long and wide.
b. In light snow, with tail marks. Hind and front feet make one elongated print, about 1¼ in. long. Leaps measured 3 to 9 in.
c. On very light layer of snow. Leaps 5 to 8 in.
d. On firm snow. Leaps 2 to 3 in.
e. Slow run in wet mud. Individual tracks about 5/16 in. wide.

117

NATURAL CYCLES - ANIMAL HABITAT - Grades: 4-5

INVESTIGATING ANIMALS AT AH-NEI - 2½ Hours

OBJECTIVE:

1. To provide field experience so that students can discover and investigate homes used by different animals.

MATERIALS NEEDED:

field notebook
pencil
hand lenses
small tape measure
sharp nails
baggies
set of questions for each student
charcoal
drawing paper

I. ALIASES: (30 minutes)

Awareness activities developed to stimulate student interest in animals and their habitat.

A. CHOOSING OUR DISGUISE:

1. Sit in a circle. Ask the students to think about what kinds of animals might live in this area.

2. "Which of those animals would you most like to turn into?"

3. Go around the circle and hear each student's chosen alias.

4. Ask each student why he chose that animal -- what qualities does that animal have that he likes best.

5. Have students close their eyes and imagine they are their favorite animal.

B. ANIMAL TRACKS:

1. While walking through the study area, have students walk like their favorite animals -- or call out several animals and walk like them. (example - soaring hawks, hopping snowshoe rabbits, lumbering bears, bounding deer, etc.)

So far you have helped your students:

- -- Think about animals in the area.
- -- Use creative expression in describing animals.

II. A HOLE INVESTIGATION:

Activities designed to explore animal habitat in this environment.

A. CANVASSING THE AH-NEI NEIGHBORHOOD: (30 minutes)

1. In pairs students explore the area for 5 minutes in order to select a hole for investigation. Before beginning, discuss tunnels, trenches, natural openings in trees, rocks, logs, streambank homes, mounds, tree holes, etc.

2. Explore your hole without destroying it. Return to the large group.

3. Group discussion:

    -- "What kind of animal could use that opening?"

    -- "Could more than one animal use it?"

    -- "What is the purpose of the shape and size of the hole?"

    -- "How do you suppose the holes or openings were made?"

    -- "How do you think these openings or holes affect the soil?"

    -- "How do these holes, in your opinion, affect man and his activities?

    -- "What harmful affects, if any, might these openings have on the environment?"

    -- "Do the holes benefit the environment?"

4. In the same teams, return to your selected "hole" with the equipment given to you. Examine the "hole" and answer the following:

    a. Is the opening in use? Evidence?

    b. What is the opening being used for?

    c. Was the hole constructed by the animal using it? If not, how was it constructed?

    d. Could more than one kind of animal use it?

    e. What is the purpose of the shape and size of the hole?

    f. Is the hole placed so that its owner can observe from it without being seen?

    g. Is it in a good spot for warmth?

    h. What does its location in a creek bank or at the base of a tree tell about soil composition from the opening?

    i. Has the opening been so constructed or is its location so that its occupants are protected from the weather?

5. Return to the large group.

    Group discussion of your findings.

So far you have helped your students:

-- Develop an awareness of "holes" and their relationship to animal behavior in their environment.

B. VISITING SPECIFIC HOMES: (45 minutes)

1. Divide the class into 5 groups. Each group is assigned one of the following types of holes to investigate.

    a. Tunnels and trenches - to study gophers, foxes, woodchucks, rockchucks, etc.

    b. Streambank homes - reptiles, insects, birds.

c. Tree dwellings - study of birds that live in holes.

d. Large and small natural openings - study of mice, ground squirrels, chipmunks, coyotes, bobcats, etc.

e. Small mounds - to study and acquaint students to types of invertebrates that use small mounds - ants, earthworms, larva of tiger beetles, etc.

2. Introduction to your hole:

   a. What kind of animal do you feel could use this opening and how would he use it?

   b. Could more than one kind of animal use the opening?

   c. What is the purpose of the shape and size of the hole?

   d. How do you suppose the holes or openings were made?

   e. How do you think these openings or holes affect the soil?

   f. How do these holes, in your opinion, affect man and his activities?

   g. What harmful affects, if any, might these openings have on the environment?

   h. Do the holes benefit the environment?

3. Get closer:

   a. Is the opening in use? Evidence?

   b. What is the opening being used for?

   c. Was the hole constructed by the animal using it? If not, how was it constructed?

   d. Could more than one kind of animal use it?

   e. What is the purpose of the shape and size of the hole?

   f. Is the hole placed so that its owner can observe from it without being seen?

   g. Is it in a good spot for warmth?

4. And finally - can you find?

   a. Guard hairs.

   b. Foliage within the holes.

   c. Nesting material found in the holes.

   d. Animal scat - waste material.

   e. Discarded material due to construction.

   f. Record measurements of holes.

   g. Record overstory and understory plant life found in areas of the holes.

   h. Note specific location of the holes.

   i. Type of construction used in making the hole.

5. Assemble your findings for a group report to whole class. You may use props. Remember - don't destroy the hole.

C. ASSESSING THE AH-NEI NEIGHBORHOOD:

1. Group reports on their specific investigations.

2. Class discussion on reports.

3. With the class, build a food chain using the animals investigated.

So far you have helped your students:

-- Develop an understanding of the role environment plays in determining the types of homes used by animals and how they use it.

-- Conceptualize a food chain.

III. THE "HOLE" THING: (15 minutes)

A concluding activity to sum up students feelings about today's investigations.

A. Students sit by the hole your team investigated and draw it. Return to the group.

B. CINQUAIN

1. Name your hole.
2. Write 2 descriptive words about it.
3. Write 3 action words about it.
4. In 4 or 5 words, describe its relationship to the environment.
5. Sum up your feelings in one word.

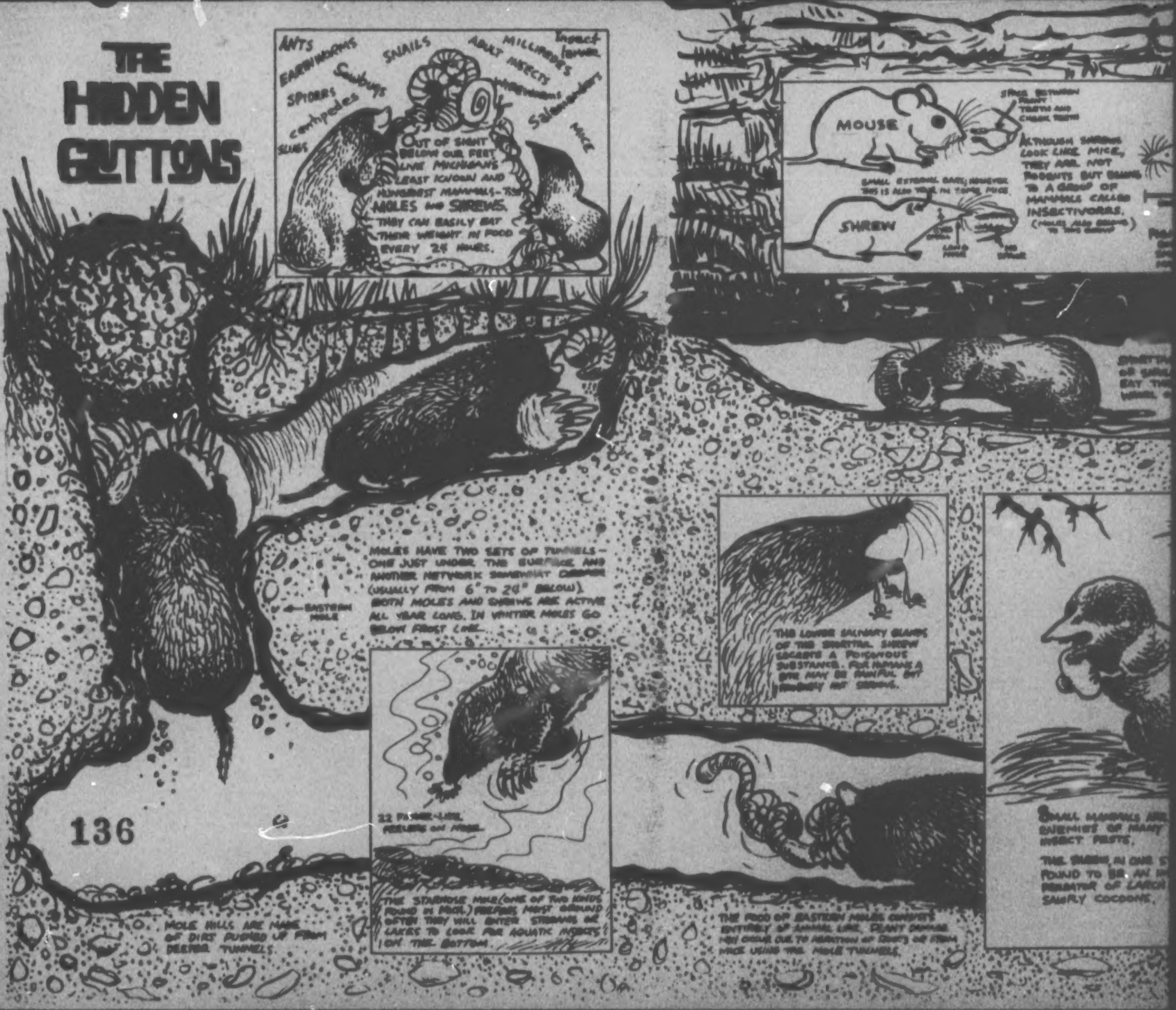
So far you have helped your students:

-- Use creative expression in the out-of-door environment.

-- Describe their feelings about animals homes.

123

THE HIDDEN GLUTTONS



OUT OF SIGHT BELOW OUR FEET LIVE MICHIGAN'S LEAST KNOWN AND HUNGRIEST MAMMALS– THE **MOLES** AND **SHREWS**. THEY CAN EASILY EAT THEIR WEIGHT IN FOOD EVERY 24 HOURS.

SMALL EXTERNAL EARS; HOWEVER THIS IS ALSO TRUE IN SOME MICE

ALTHOUGH SHREWS LOOK LIKE MICE, THEY ARE NOT RODENTS BUT BELONG TO A GROUP OF MAMMALS CALLED INSECTIVORES. (MOLES ALSO BELONG TO THIS GROUP)

SHORTTA
OR SHRE
EAT TH
WHOLE

MOLES HAVE TWO SETS OF TUNNELS– ONE JUST UNDER THE SURFACE AND ANOTHER NETWORK SOMEWHAT DEEPER (USUALLY FROM 6" TO 24" BELOW). BOTH MOLES AND SHREWS ARE ACTIVE ALL YEAR LONG. IN WINTER MOLES GO BELOW FROST LINE.

22 FINGER-LIKE FEELERS ON NOSE.

THE STARNOSE MOLE (ONE OF TWO KINDS FOUND IN MICH.) PREFERS MOIST GROUND. OFTEN THEY WILL ENTER STREAMS OR LAKES TO LOOK FOR AQUATIC INSECTS ON THE BOTTOM.

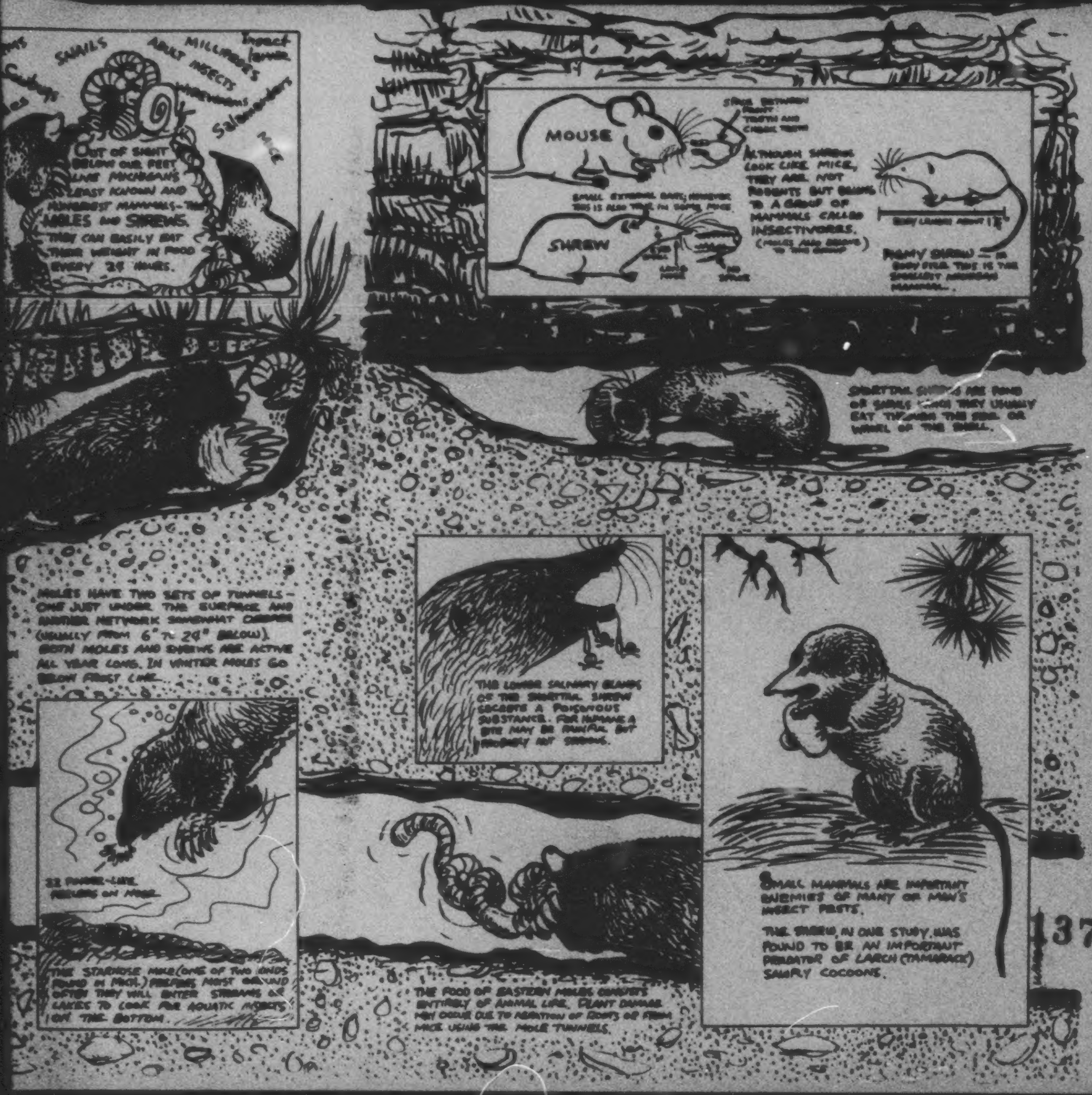
THE LOWER SALIVARY GLANDS OF THE SHORTTAIL SHREW SECRETE A POISONOUS SUBSTANCE. FOR HUMANS A BITE MAY BE PAINFUL BUT PROBABLY NOT SERIOUS.

SMALL MAMMALS ARE ENEMIES OF MANY INSECT PESTS.

THE SHREW IN ONE S
FOUND TO BE AN I
PREDATOR OF LARCH
SAWFLY COCOONS.

MOLE HILLS ARE MADE OF DIRT PUSHED UP FROM DEEPER TUNNELS.

THE FOOD OF EASTERN MOLES CONSISTS ENTIRELY OF ANIMAL LIFE. PLANT DAMAGE MAY OCCUR DUE TO AERATION OF ROOTS OR FROM MICE USING THE MOLE TUNNELS.



OUT OF SIGHT BELOW OUR FEET LIVE MICHIGAN'S LEAST KNOWN AND HUNGRIEST MAMMALS—THE MOLES AND SHREWS. THEY CAN EASILY EAT THEIR WEIGHT IN FOOD EVERY 24 HOURS.

SPACE BETWEEN FRONT TEETH AND CHEEK TEETH

SMALL EXTERNAL EARS; HOWEVER THIS IS ALSO TRUE IN SOME MICE.

ALTHOUGH SHREWS LOOK LIKE MICE, THEY ARE NOT RODENTS BUT BELONG TO A GROUP OF MAMMALS CALLED INSECTIVORES. (MOLES ALSO BELONG TO THIS GROUP)

BODY LENGTH ABOUT 1½"

PIGMY SHREW — IN BODY SIZE THIS IS THE SMALLEST MICHIGAN MAMMAL.

SHORTTAIL SHREWS ARE FOND OF SNAILS WHICH THEY USUALLY EAT THROUGH THE SIDE OR WHORL OF THE SHELL.

MOLES HAVE TWO SETS OF TUNNELS—ONE JUST UNDER THE SURFACE AND ANOTHER NETWORK SOMEWHAT DEEPER (USUALLY FROM 6" TO 24" BELOW). BOTH MOLES AND SHREWS ARE ACTIVE ALL YEAR LONG. IN WINTER MOLES GO BELOW FROST LINE.

THE LOWER SALIVARY GLANDS OF THE SHORTTAIL SHREW SECRETE A POISONOUS SUBSTANCE. FOR HUMANS A BITE MAY BE PAINFUL BUT PROBABLY NOT SERIOUS.

22 FINGER-LIKE FEELERS ON NOSE.

THE STARNOSE MOLE (ONE OF TWO KINDS FOUND IN MICH.) PREFERS MOIST GROUND. OFTEN THEY WILL ENTER STREAMS OR LAKES TO LOOK FOR AQUATIC INSECTS ON THE BOTTOM.

THE FOOD OF EASTERN MOLES CONSISTS ENTIRELY OF ANIMAL LIFE. PLANT DAMAGE MAY OCCUR DUE TO AERATION OF ROOTS OR FROM MICE USING THE MOLE TUNNELS.

SMALL MAMMALS ARE IMPORTANT ENEMIES OF MANY OF MAN'S INSECT PESTS.

THE SHREW, IN ONE STUDY, WAS FOUND TO BE AN IMPORTANT PREDATOR OF LARCH (TAMARACK) SAWFLY COCOONS.

COLD PROOFING-

MOTHER NATURE'S WAY.

WARM-BLOODED ANIMALS CAN LIVE IN COLD AREAS BECAUSE THEY MAINTAIN THEIR BODY TEMPERATURES-

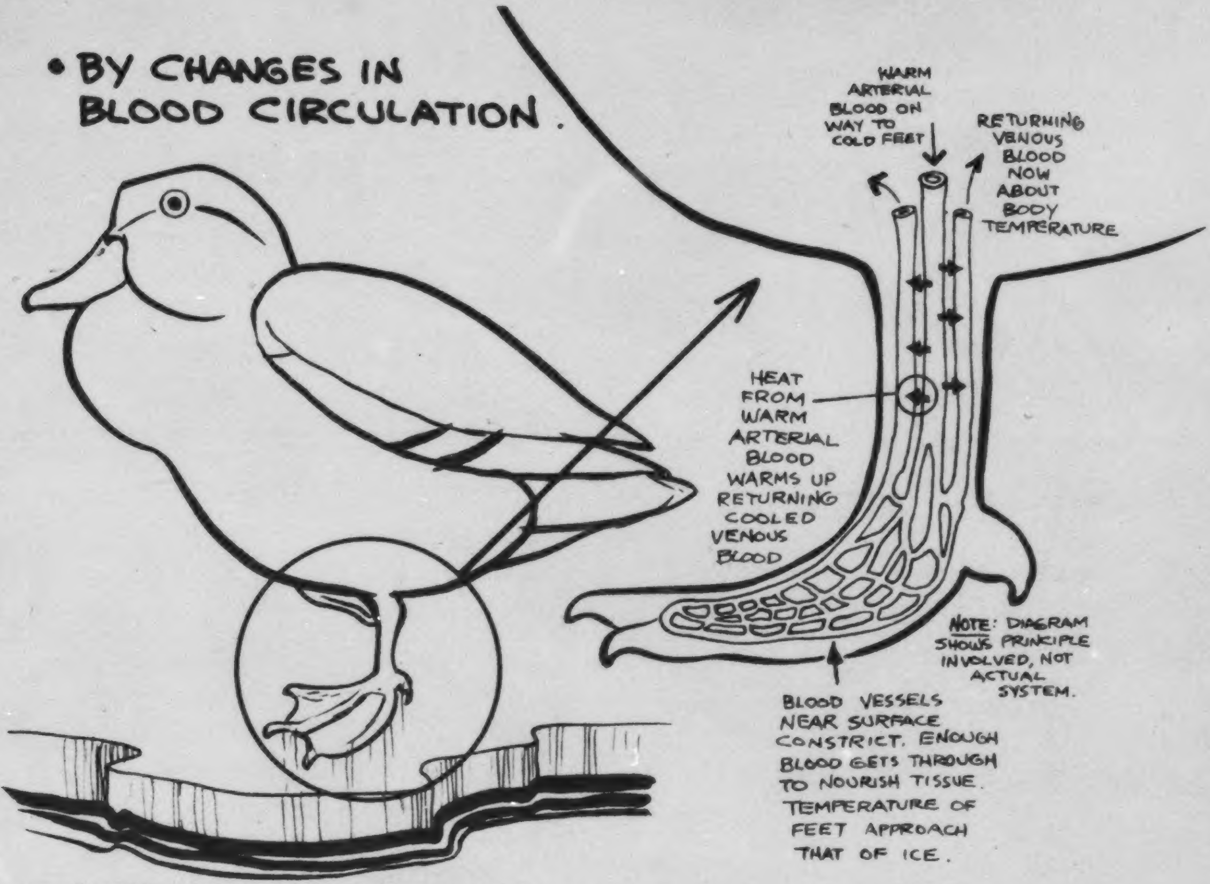
• BY INSULATION.

DEER GROW A THICK WINTER COAT THAT CONSISTS OF LONG, HOLLOW HAIRS. AIR TRAPPED IN THE CORE OF THESE HAIRS KEEPS THE COLD OUT AND BODY HEAT IN.

OTTERS AND MUSKRATS HAVE DENSE UNDERFUR THAT TRAPS AIR TO KEEP COLD WATER FROM CONTACTING THE SKIN.

BIRDS FLUFF UP THEIR FEATHERS TO INCREASE THE INSULATING AIR LAYER. BY TUCKING IN THEIR BILLS HEAT LOSS FROM BREATHING IS ALSO REDUCED.

• BY CHANGES IN BLOOD CIRCULATION.


WARM ARTERIAL BLOOD ON WAY TO COLD FEET
RETURNING VENOUS BLOOD NOW ABOUT BODY TEMPERATURE
HEAT FROM WARM ARTERIAL BLOOD WARMS UP RETURNING COOLED VENOUS BLOOD

NOTE: DIAGRAM SHOWS PRINCIPLE INVOLVED, NOT ACTUAL SYSTEM.

BLOOD VESSELS NEAR SURFACE CONSTRICT. ENOUGH BLOOD GETS THROUGH TO NOURISH TISSUE. TEMPERATURE OF FEET APPROACH THAT OF ICE.

A HEAT EXCHANGE CIRCULATORY SYSTEM IN DUCKS AND GULLS ALLOWS THEM TO STAND ON ICE OR TO PADDLE IN COLD WATERS.

• BY INCREASING BODY HEAT.

MANY BIRDS AND MAMMALS GENERATE EXTRA HEAT BY SHIVERING. THIS PROCESS CAN BE SO SUBTLE THAT IT IS NOT VISIBLE.

A SPECIAL FAT CALLED "BROWN FAT" PRODUCES MORE HEAT THAN OTHER TISSUES. YOUNG OF SOME MAMMAL AND HIBERNATORS HAVE IT.

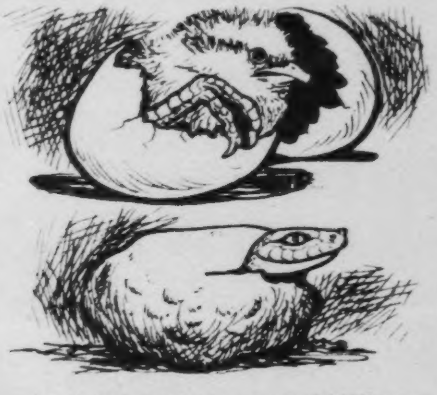
• BY CHANGES IN BODY TISSUES.

FEET OF ARCTIC MAMMALS CONTAIN A FAT THAT REMAINS SOFT AT SUB-ZERO TEMPERATURES. LOCOMOTION WOULD BE DIFFICULT IF THE FEET DIDN'T REMAIN FLEXIBLE.

126

NATURE'S GROW-WHAT-YOU-NEED PLAN

TO AID IN THE INCUBATION OF EGGS, MOST FEMALE BIRDS DEVELOP A **BROOD PATCH.** THIS BARE SPOT OF SKIN ON THE LOWER PART OF THE BODY IS PRODUCED BY MOLTING OF DOWN AND AN INCREASE IN SIZE AND NUMBER OF BLOOD VESSELS. THE PATCH DISAPPEARS AFTER USE.



A HANDY TOOL TO HELP UNHATCHED BIRDS - AND SNAKES - BREAK OUT IS THE **EGG TOOTH**. THIS TEMPORARY HORNY POINT ON THE TIP OF THE BILL OR SNOUT DROPS OFF SOON AFTER BIRTH.

COME FALL, RUFFED GROUSE GROW THEIR OWN **SNOWSHOES**. IN THE SPRING, THESE WIDE FLAPS ALONG THE SIDES OF THE TOES, DROP OFF.

TO PROVIDE ENERGY DURING SPRING BREEDING SEASON WHEN FOOD SEEMS UNIMPORTANT, TURKEY GOBBLERS DEVELOP A **BREAST SPONGE**. THIS FAT RESERVOIR MAY CONSTITUTE AS MUCH AS 11% OF THE DRESSED WEIGHT. IT IS CONSUMED BY EARLY SUMMER.

SOME NORTHERN ANIMALS GROW A **WHITE COAT** FOR WINTER CAMOUFLAGE. SHORTER DAYLIGHT INITIATES THE MOLT OF THE DARK SUMMER FUR (OR FEATHERS). WHEN DAYS GROW LONGER IN THE SPRING, THE WHITE COAT IS SHED.

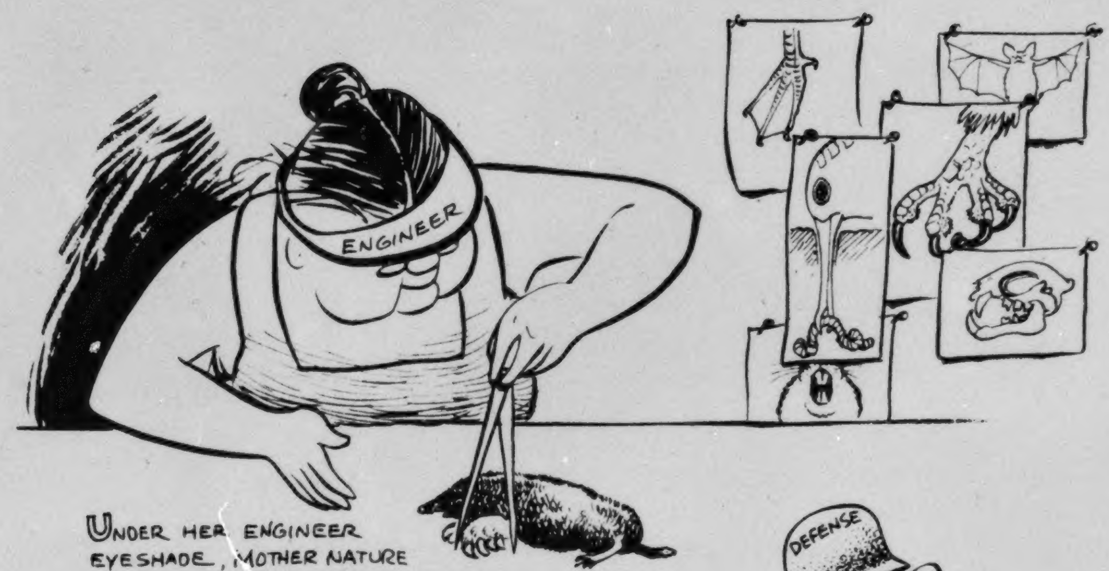
PROBABLY THE BIGGEST ANNUAL GROWTH EFFORT BY WILDLIFE IS THE GROWING OF **ANTLERS**. AFTER USE BY MALES IN DISPUTES OVER FEMALES, AND WHEN THE ENDOCRINE SYSTEM DICTATES, THE ANTLERS ARE DROPPED. A NEW SET STARTS GROWING AGAIN IN THE SPRING.

MOTHER NATURE WEARS MANY HATS

SHE WEARS A HAT OF TENDERNESS AND LOVE WHEN SHE USES CAMOUFLAGE AND OTHER TRICKS TO CARE FOR THE YOUNG.

IN HER ARTIST'S HAT, SHE PAINTS COLORFUL BIRDS, SPECTACULAR SUNSETS, LOVELY FLOWERS, AND---- WELL, JUST LOOK AROUND FOR MANY, MANY SAMPLES.

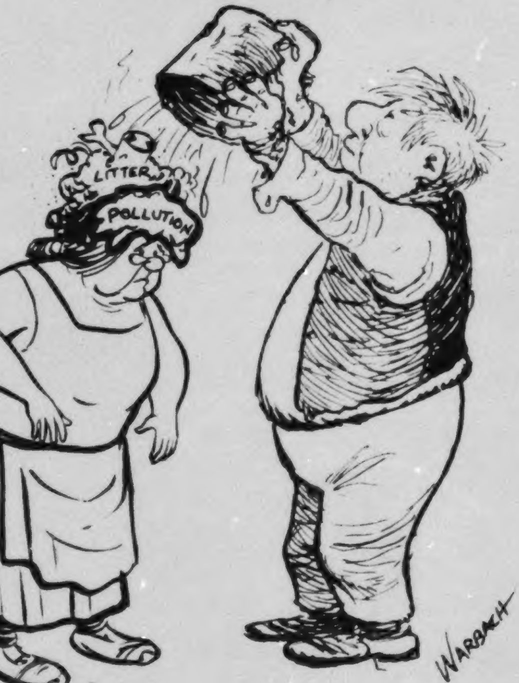
WHEN MOTHER NATURE PRODUCES MORE ANIMALS THAN SHE CAN FEED, SHE PUTS ON HER HAT THAT SYMBOLIZES RUTHLESSNESS AND GOES TO WORK.



UNDER HER ENGINEER EYESHADE, MOTHER NATURE DESIGNS ANIMALS THAT ARE MODELS OF INGENUITY AND EFFICIENCY.

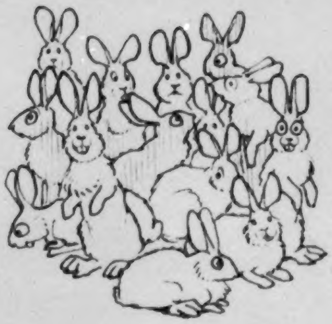
IN A HUNGRY WORLD, BARBS, TEETH, CLAWS, SCENTS, ARMOR, AND OTHER DEFENSE EQUIPMENT COME IN HANDY.

THIS HAT IS A MOST SUCCESSFUL NUMBER. UNDER THIS HAT MOTHER NATURE CAN TAKE 1 + 1 AND EQUAL 3, OR 4, OR 10, OR 1,000, OR 20,000.



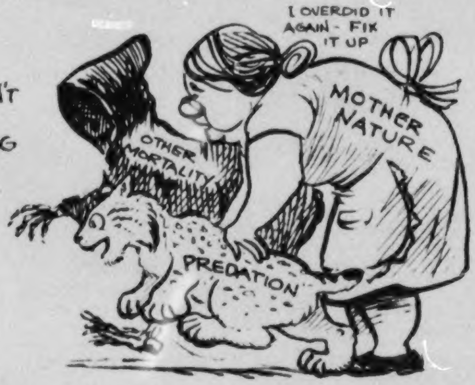
THE "HAT" BEING CREATED ON THE RIGHT IS ONE THAT MOTHER NATURE HAS BEEN FORCED TO WEAR SINCE MAN ARRIVED ON THE SCENE.

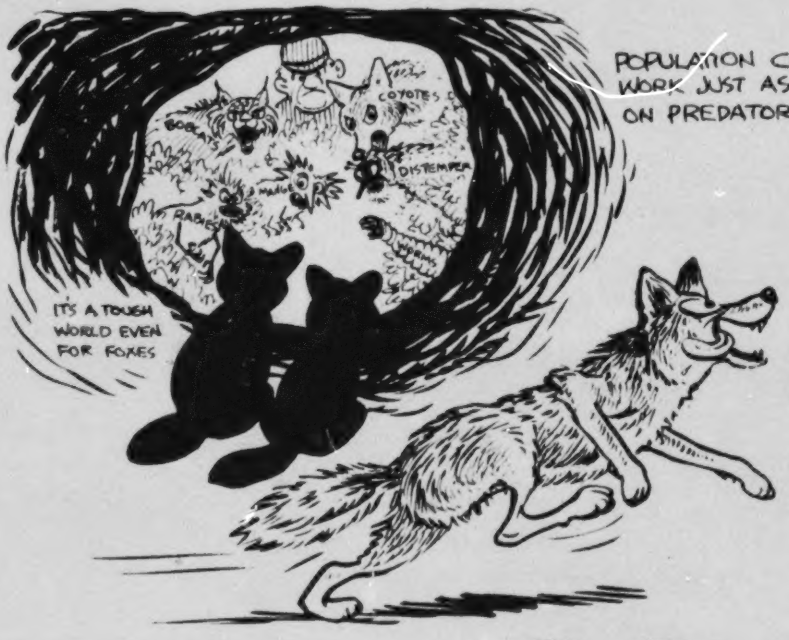
SOME FINDINGS FROM THE REAL WORLD INCLUDE THE FOLLOWING:



WHEN A SPECIES CAN'T CONTROL ITS OWN NUMBERS, SOMETHING ELSE WILL.

UNDER GOOD LIVING CONDITIONS MANY YOUNG ARE PRODUCED





POPULATION CONTROLS WORK JUST AS EFFECTIVELY ON PREDATORS.

PREDATORS USUALLY GET WHAT IS EASIEST FOR THEM. OFTEN THAT INCLUDES CONCENTRATED DOMESTIC STOCK, SURPLUS WILDLIFE, THE AGED, WEAK, THOSE TRAVELING TO NEW AREAS, THE UNLUCKY, EGGS, FRUIT, FROGS, AND DEAD CREATURES.

PREDATORS INCLUDE SOME OF THE MOST INTERESTING WILDLIFE IN THE OUT-OF-DOORS.

UNDERSTANDING PREDATION (a little)

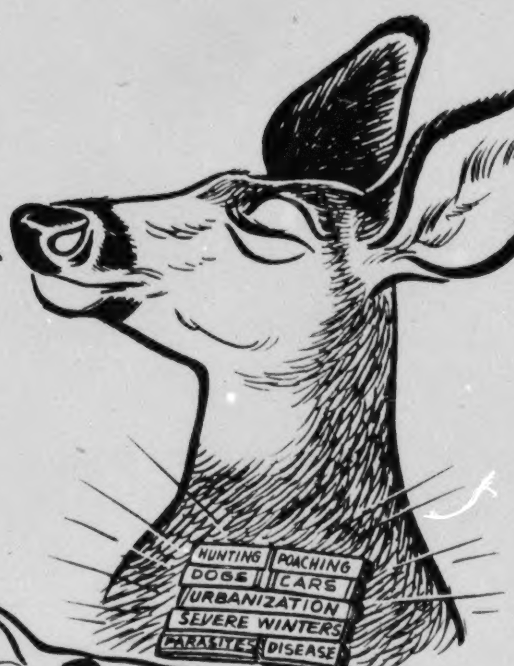
PREDATION: A RELATIONSHIP IN WHICH AN ORGANISM CAPTURES AND FEEDS ON ANOTHER.
PLANTS DO IT.
PITCHER PLANT
BIRDS DO IT.
FISH DO IT.
INSECTS DO IT.
MAMMALS DO IT.

AND THE BIG, BAD WOLF LUNGED TOWARDS LITTLE RED RIDING HOOD......

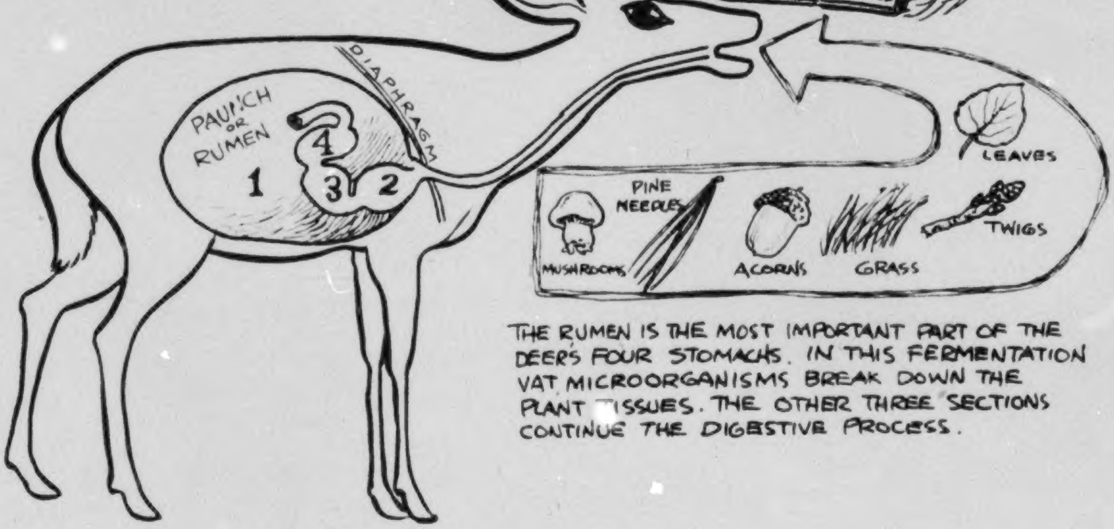
OUR MISUNDERSTANDING OF PREDATION BEGINS AT AN EARLY AGE.

UNDERSTANDING DEER

THE MULE DEER IS A VETERAN AT SURVIVAL. NOTICE ITS COMBAT RIBBONS. LET'S TAKE A CLOSER LOOK AT THIS DURABLE AND ADAPTABLE BIG GAME ANIMAL.



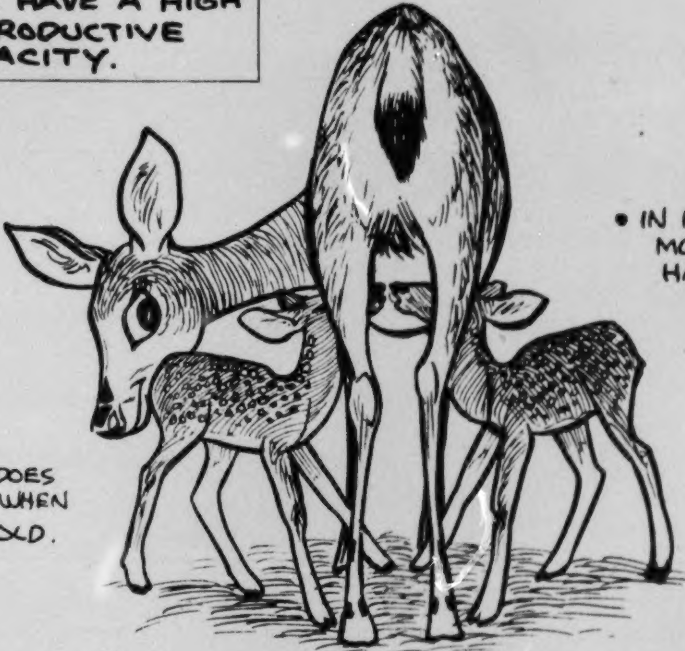
THEY HAVE A DIGESTIVE SYSTEM THAT CAN HANDLE A VARIETY OF PLANT MATERIALS.



THE RUMEN IS THE MOST IMPORTANT PART OF THE DEER'S FOUR STOMACHS. IN THIS FERMENTATION VAT MICROORGANISMS BREAK DOWN THE PLANT TISSUES. THE OTHER THREE SECTIONS CONTINUE THE DIGESTIVE PROCESS.

HOWEVER - ALL PLANTS ARE NOT DEER FOOD. YEARS OF STUDIES HAVE SHOWN THAT DEER FOODS, MAY BE DIVIDED INTO THREE GROUPS:

DEER HAVE A HIGH REPRODUCTIVE CAPACITY.

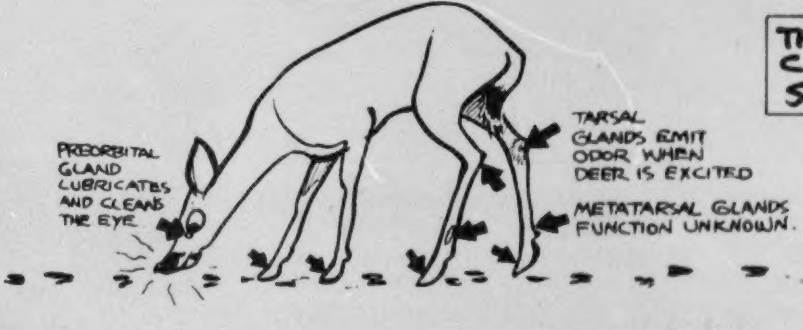


- IN FAVORABLE AREAS, MOST DOES WILL HAVE TWINS.
- USUALLY DOES BREED WHEN 1½ YRS. OLD.
- IN GOOD FOOD AREAS, MORE THAN HALF OF THE FAWNS WILL BREED AT 7 TO 8 MONTHS.

THEIR SENSES ARE HIGHLY DEVELOPED.

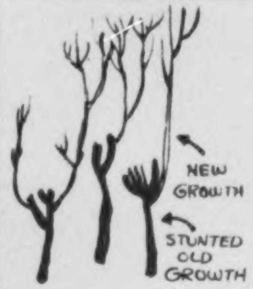
DEER HAVE AN ACUTE SENSE OF SMELL, KEEN HEARING AND EYES THAT ARE ESPECIALLY GOOD AT DETECTING MOVEMENT. HOWEVER, THEY ARE COLOR BLIND.

THEY HAVE A CHEMICAL COMMUNICATION SYSTEM.


PREORBITAL GLAND LUBRICATES AND CLEANS THE EYE
TARSAL GLANDS EMIT ODOR WHEN DEER IS EXCITED
METATARSAL GLANDS FUNCTION UNKNOWN.

THE INTERDIGITAL GLAND (BETWEEN THE TOES) AIDS IN LOCATING OTHER DEER OR FOR BACKTRACKING.

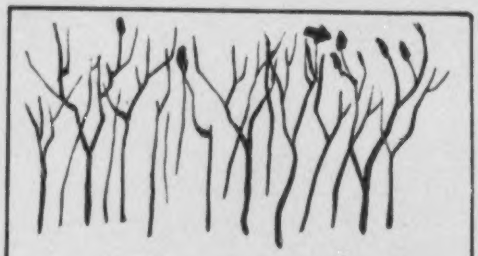
BROWSING ON SPRUCE, BALSAM FIR, RED PINE, AND OTHER STARVATION FOODS, MEANS, BETTER FOODS ARE GONE OR IN SHORT SUPPLY.



A SIGN OF REDUCED DEER POPULATIONS IN AN OVER-BROWSED HARDWOOD STAND IS THE PERSISTENCE OF NEW GROWTH FOR 2 OR 3 YEARS.

NO TREE REPRODUCTION 5 OR 6 YEARS AFTER A CUTTING OF TREES, MEANS A HIGH LEVEL OF DEER FOR AMOUNT OF FOOD IN THE AREA.

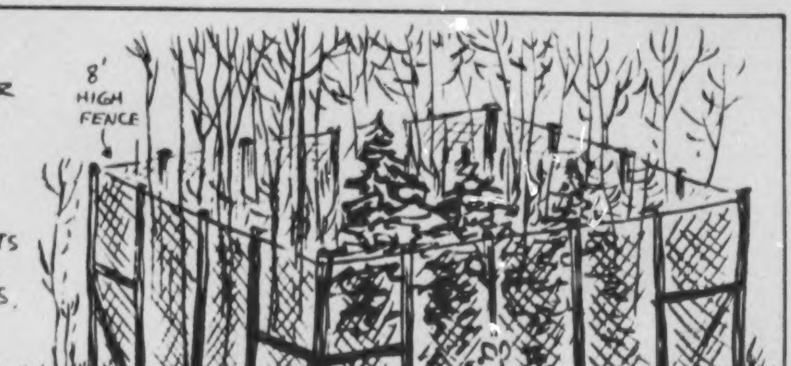
DIGGING DOWN THROUGH SNOW FOR FOOD COULD MEAN NOT MUCH AVAILABLE ABOVE.



ABSENCE OF SUMAC "BOBS" OR SEED HEADS IS ANOTHER SIGN OF HEAVY DEER USE.

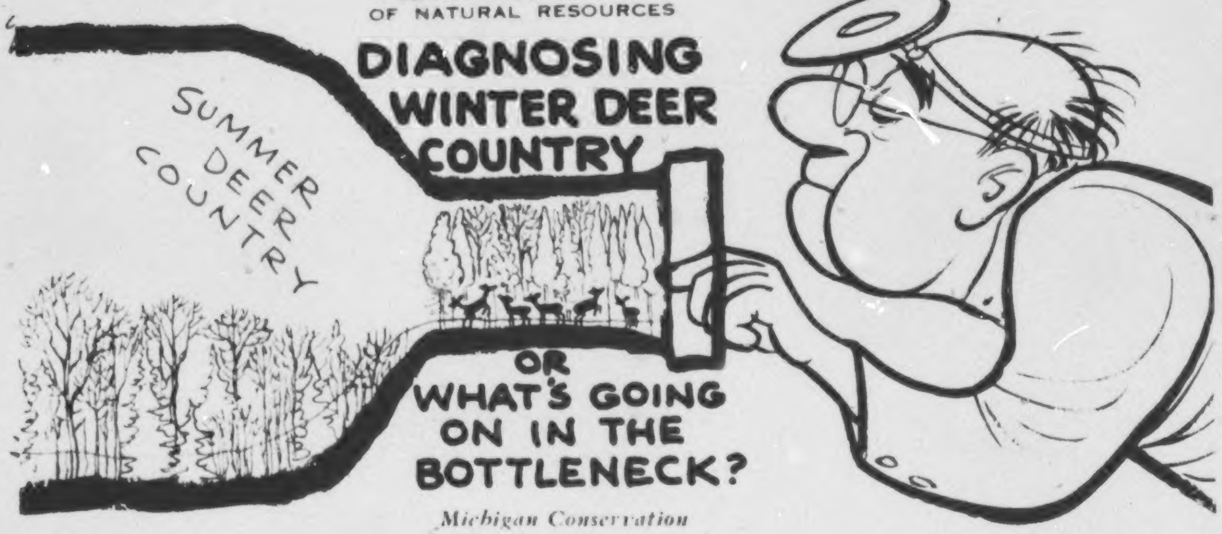
"EXCLOSURES" – A BIT OF WOODLAND THE DEER CAN'T GET TO – ARE USED TO DETERMINE KIND, AMOUNT, AND REGROWTH RATE OF DEER FOOD.

IF DESIRABLE PLANTS ARE BEING REPLACED BY POOR FOOD SPECIES, THIS ALSO CAN BE OBSERVED.

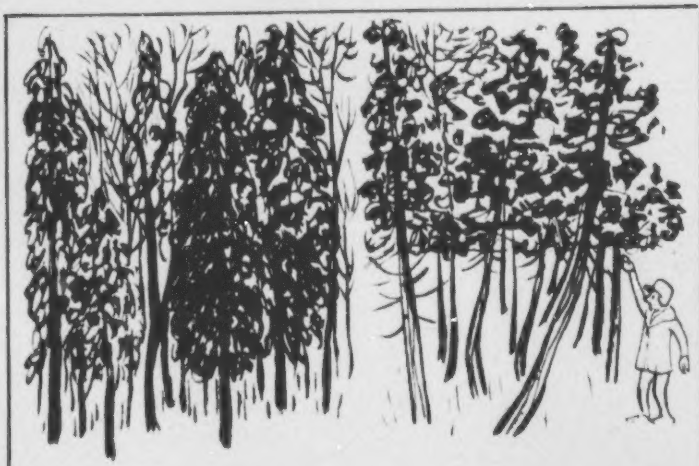


MICHIGAN DEPARTMENT
OF NATURAL RESOURCES

DIAGNOSING WINTER DEER COUNTRY OR WHAT'S GOING ON IN THE BOTTLENECK?



Michigan Conservation
March-April, 1966

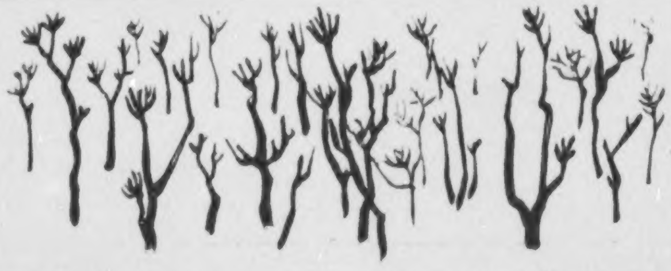


CEDAR SWAMPS THAT LOOK LIKE THIS -(NOT AS MANY NOW) — HAVE FOOD FOR WINTERING DEER.

PARK-LIKE LOOK WITH LITTLE UNDERGROWTH MEANS SHORTER WINTER RATIONS FOR YARDING DEER.

← WHITE PINE, YELLOW BIRCH OR OTHER SPECIES EATEN BY DEER

THE ABSENCE OF SEEDLINGS AROUND MATURE SEED PRODUCING TREES IS A GOOD INDICATION OF A HIGH DEER POPULATION.



CLUBBY APPEARANCE OF UNDERGROWTH -(MAPLE, RED-OSIER DOGWOOD, VIBURNUM)- IS A SIGN OF YEARS OF HEAVY BROWSING.

March 3, 1849

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
COLORADO STATE OFFICE
ROOM 700, COLORADO STATE BANK BUILDING
1600 BROADWAY
DENVER, COLORADO 80202

IN REPLY RE
5-912
1790.8

August 24, 1973

"INQUIRIES INTO THE ENVIRONMENT"

LESSON PLAN: An Environmental Study of an Aspen Niche "In the Niche of Time"

I. Objectives:

A. To create an awareness in students of the complexities found in a "mini" environment.

B. To create in students an understanding and appreciation of the interdependence and relationship between the different types of life and physical phenomena necessary to perpetuate a "mini" environment through investigation by inquiry and experimentation.

II. Classroom Materials:

A. Slides of a thriving aspen niche or large picture showing the same.

B. Close-up slides depicting the different kinds of life found in an aspen niche.

C. A dittoed copy of the following inquiry questions for each participant:

1. What do you feel, from the slide or picture, is an aspen niche?
2. What is the physical setting of this aspen niche as you view it?
3. What evidence is there that life is supported by this aspen niche?
4. From the evidence given, what kind of life could be supported in the niche?
5. What evidence is there that animal life is dependent upon other animal life within the niche? If so, what animal life?
6. Is there evidence that the aspen niche benefits the animal life found there? If so, how?

7. What type of plants are found in the niche?

8. What role do the plants play in supporting the niche?

D. Divide class into groups of 3 to 5. Each group to answer inquiry questions. Answer only from information given in the slides or pictures. Allow from 15 to 20 minutes.

E. Regroup small groups into one large group and discuss inquiry questions.

III. Post Classroom Activities:

A. Field Trip

1. Teacher to choose aspen niche comparable to the one pictured in the slides used in the classroom.

2. Divide participants into groups - Allow to choose according to interest - Maximum number in a group 5. Teacher may have to do some arbitrary choosing.

3. Groups and materials:

a. Bird group

- Materials needed:

(1) Binoculars
(2) Tape measure
(3) Hand lens
(4) Tape recorder
(5) Notebooks
(6) Bird field guide
(7) Plastic bags
(8) Each student a set of field inquiry questions.

- Activities:

(1) Identify species of birds - where found, color markings, types of nests. Take notes on these.

(2) Record calls, if possible, and identify species making the calls.

(3) Collect nests and scat-carry in bags for further study.

(4) Make drawings of nests not collectable (height, size or size of hole, direction it faces, materials in the nest, etc.).

(5) Field notes on eating and other habits.

(6) Group to answer inquiry questions on the aspen niche.

b. Small animal group (worms, snails, insects, etc.)

- Materials needed:

(1) Field notebooks
(2) Each student a set of field inquiry questions
(3) Micro-bio guns
(4) Hand Lens
(5) Net with handle
(6) Garden trowel
(7) Plastic bags
(8) Animal field guide

- Activities:

(1) Take sample profiles of soil in the niche to determine kind of insects, larvae and eggs found in the soil.

(2) Collect sample of flying and crawling insects. Put in plastic bags.

(3) Take notes on all observed activities of animals and number.

(4) Identify by species - make list.

(5) Study bark of trees for insects - mites.

(6) Make drawings of different kind of homes of small animals.

(7) Group to answer inquiry questions on the aspen niche.

c. Tree Study group - overstory - Materials needed:

(1) Increment bore
(2) Tape measure
(3) Clear soda straw
(4) Set of field inquiry questions on the aspen niche
(5) Tree field guide

- Activities:

(1) Population study of trees in the niche - number and species.

(2) Age of trees - determine with increment bore (take a sampling of each species and a sampling of different size aspen.).

(3) Put bore of tree in soda straw to preserve.

(4) Do an analysis of signature patterns on rings of the bore (no. of wet years vs. dry years).

(5) Determine board foot of Aspen niche - do wide sampling of trees (Formula in forest guide).

(6) Field notes on kind of homes provided by the trees.

(7) Group to answer field inquiry questions on aspen niche.

d. Plant Study group - understory - Materials needed:

(1) Field notebook
(2) Plant field guide
(3) Flower disecting kit
(4) Hand lens
(5) Garden trowel
(6) Plastic bags
(7) 6-inch ruler
(8) Set of field inquiry questions

- Activities:

(1) Do random plot studies of aspen niche - plots 6 feet by 6 feet (at least 6). Identify each plant and amount of shade it occupies within the plot (percentage). Estimate amount of area in plot covered by litter (twigs, rocks and leaves).

(2) Collect leaves - describe characteristics - veins, flower parts (use hand lens). Findings to be put in notebook.

(3) Separate flowering plants in two groups - dicots - monocots. Note the differences and number of each. (Veins - no. of flowering parts, type of root systems).

(4) Collect samples of lichens, mosses - fungi, ferns - liverworts - classify each in notebook. Group each according to characteristics.

(5) Group to answer field inquiry questions.

e. Large Animal group

- Materials needed:

(1) Mammal field guide
(2) Animal tracks field guide
(3) Hand lens
(4) Binoculars
(5) Patch plaster
(6) Plastic bags
(7) Burlap bags
(8) Field traps if permissable
(9) Inquiry questions

- Activities:

(1) Collect scat for study - take samples for microscopic study - determine what the animals eat - take notes.

(2) Take casts of animal tracks - identify - take notes.

(3) Take field notes on animals that are in the aspen niche. Use binoculars (what they are doing, special markings like protective coloration, etc.).

(4) Take notes on other evidences of animals not collectable and not seen - tooth marks on aspen, claw marks, dirt mounds, homes, etc.).

(5) Collect frogs - snakes - salamanders, etc., for identification.

(6) Optional - only do if permission granted - trap small animals over area to determine population - period of seven days.

(7) Group to answer study questions.

f. Soil - water - air group

- Materials needed:

(1) Garden trowel
(2) Hand lens
(3) Hach kit
(4) La Motte soils analysis kit
(5) Johnny Horizon Environmental test kit
(6) Weather instruments - barometer - hygrometer - wind vane - thermometer
(7) Plastic bags
(8) Set of field inquiry questions

- Activities:

(1) Make micro-monolith profiles of the soil (horizons of the soil) - cross section of litter - duff - humus - top soil - subsoil. Take notes on the life in the soil.

(2) Use La Motte kit to test soil in sampling of areas in the niche for lime content.

(3) Take the temperature of the soil, and air and water if there is any in the area. Record data.

(4) Collect data on humidity, gauge speed and direction of wind.

(5) If water is present, use Hach kit to determine Ph. factor. Dissolved oxygen parts per million, etc. (Do several samples).

(6) Croup to answer field inquiry questions.

IV. Field Inquiry Questions:

1. What is an aspen niche?

2. What is the physical setting of this aspen niche?

3. What kind of life is supported by the niche and what are the evidences?

4. What elements are needed to maintain the niche?

5. What animal life is found in the niche?

6. What animal life is dependent upon other animal life within the niche and what are the evidences?

7. Does the animal life benefit the niche? How?

8. How does the aspen niche benefit the animal life found there?

9. What are the characteristics of the soil in the niche?

10. What role do the plants play in supporting the niche?

11. Is the life of the niche terminal?

12. What conditions were present to create the niche?

V. Classroom follow-up:

1. Display findings in the field and through lab work.

2. "Clean-up" notes for future reference.

3. Make wall murals showing the interdependence of life in the niche - from the simple to the complex.

4. Make oral presentations of findings on further study.

5. Individual project work - choice -

    a. Research/report.
    b. Visual presentations.
    c. Creative writing.
    d. Student choices.

6. High school panel discussion presentation for the whole student body followed by questions and answers. (Preservation and care of niche; man's role; discuss pluses and minuses of niche).

7. Discuss comparison from observed answers of slide pictures to those found in the field and in-depth study.

8. Do a comparative energy study of two aspen niches. (Bonus)

VI. Alternate Methods of Teaching

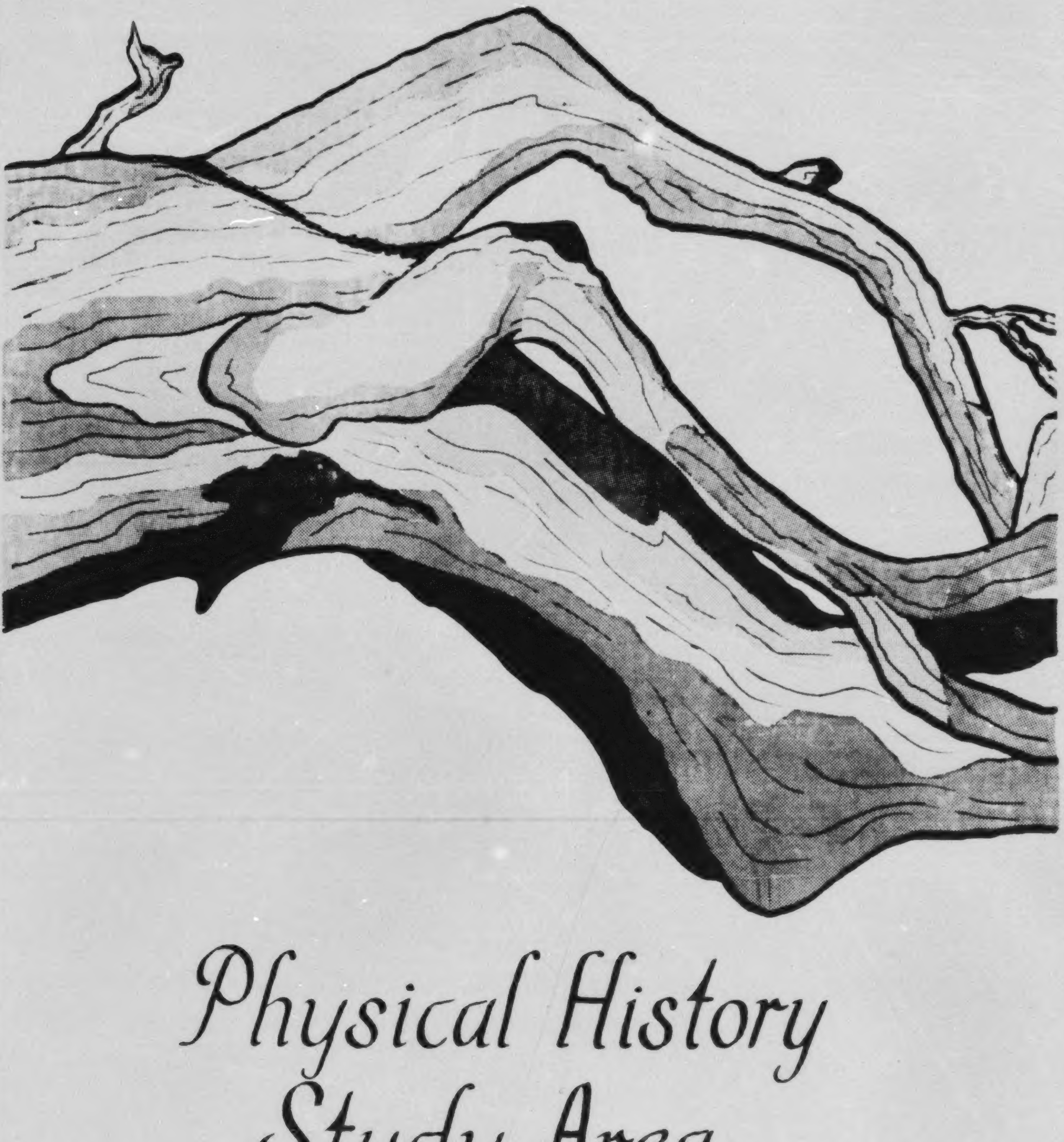
1. Total class do each group activity. Length depends on interest.

2. Minimize activity according to teacher's discretion and students' sophistication.

3. Each group activity can be taught as a separate entity.

4. Lesson can be done without inquiry questions.

This lesson plan was prepared by Jack Pyle for the Bureau of Land Management Any suggestions for alteration of plan would be appreciated.



Physical History Study Area

PHYSICAL HISTORY STUDY AREA

I. DESCRIPTION:

(Sedimentary means any rock formed of loose sediment such as sand, mud, or gravel deposited on the earth's surface.) The Physical History Study Area is located atop a sedimentary rimrock formation, surrounded by deep cuts and drainages, gradually tapering into gently rolling hills and knolls. While standing on the eastern end of the rim, one can view the Beartooth Mountains, the Crazies, the Snowy Mountains, and the Pryors. This offers an excellent opportunity for discussions on different types of mountain formations, as well as a study area for local sedimentary processes.

Outcroppings of a sedimentary formation are found in this area. Known as the Hell Creek formation, it consists of alternating beds of yellowish grey sandstone, drab colored clays and grayish sandy shale. It was formed during the Cretaceous age, when dinosaurs became extinct and early mammals and flowering plants developed.

Sandstone is a rock consisting of sand grains held together by cement. Quartz is the most common sand. Because all sandstones are porous, they hold ground water. Grains forming sandstone vary in size.

Shale is made of clay, silt, mud or a mixture of these substances. Shales have not been changed much since they were deposited so they preserve many of their original characters and markings as well as great numbers of fossils. Ripple marks from ancient seas, mud cracks, rain prints, and tracks made by animals ranging from worms to dinosaurs are preserved in shales.

II. DESIRED STUDENT OUTCOMES:

1. To make students aware of the geologic processes occurring and affecting our local physical geography.
2. To develop in students an appreciation of a rimrock environment so that as future adult citizens they may be involved in sensible but feeling land-use and resource decisions.
3. To promote an understanding of early man's intimate relationship with his environment.

III. EXTENDING THE "AH-NEI" EXPERIENCE:

Teachers are encouraged to prepare their students for the "Ah-Nei" visit. The following activities are suggestions for preparation and follow-up activities for the Physical History Study Area.

- -- Vocabulary study of key lesson-plan words.
- -- Dinosaur study.
- -- Introduction to rocks characteristics.
- -- What is a Dichotomous Key?
- -- History of man at "Ah-Nei."
- -- Indian culture in the area.
- -- Fossil study.

- -- Use natural clay for modeling.
- -- Do sandstone carvings.
- -- Measure and compare size, shapes and weights of various rocks.
- -- Rock collecting and classifying with all types of rocks.
- -- Make a model of the area during the Cretaceous period, including dinosaurs, etc.
- -- Dramatize early man at "Ah-Nei."
- -- Learn about and act out a Crow Indian ceremonial that might have taken place at "Ah-Nei."
- -- Compose a myth or legend about "Ah-Nei."

PHYSICAL HISTORY STUDY AREA - Grades: K-1

ROCKS AND SOIL - 2 Hours 15 Minutes

OBJECTIVE:

1. To make students know the different kinds of rocks and soils available at Ah-Nei.

MATERIALS NEEDED:

a whistle
collecting bags for each student
glue
paper

I. THE SENSITIVE STONE: (30 minutes)

This is an awareness activity designed to show students how to use their senses with the soil and rocks.

A. Have students spread out in large area within hearing distance.

B. Ask each student to pick up a rock or stone.

   1. Examine the stone closely with eyes. (Note the characteristics verbally.

   2. Close your eyes. Using only sense of touch, feel the stone with your hands, cheeks, etc.

   3. Now use sense of taste. Touch your tongue to the stone and verbalize your taste to the other students.

   4. Using only your nose, sniff the stone. Does it have an odor?

   5. Roll the stone between your hands and only listen to the sound it makes. Pick up a leaf or a blade of grass and roll them together for sound. Pick up another stone and roll them together - Listen!

So far you have helped your students:

-- use all their senses independently to examine and become familiar with a stone.

II. "WHAT KIND OF ROCK AM I?" (45 minutes)

Activity designed to inventory and investigate the rocks in the area.

A. Tell students the next half hour they will spend hunting for rocks. They are to find as many different kinds of rocks as possible.

B. Pass out bags to each student.

C. Blow whistle once and tell them next time they hear whistle to return to this spot. Be sure they don't wander too far out of sight.

D. When students return, sit in a big circle.

E. Have each student empty his bag on the ground and compare stones.

F. Let students select their own methods of sorting. (shape, color, size, kind, etc.)

G. Compare methods and ideas and sort your own with the class - encouraging help from them. Students are keying their own stones.

H. Is it possible to return your stones to their original spot? Whose home might you have disturbed?

So far you have helped your students:

-- discover for themselves the visual differences in rocks.
-- group their stones according to the physical aspects.

III. "LAYER THE SOIL" (30 minutes)

(Patterns) This is an activity designed to show students how the soils and rocks are put together.

A. Lead students to a cut in the soil. (A cliff where layers of soil are visible will work.)

B. Have students reach up and feel the different layers. Do they all feel the same or different?

C. Have students smell the different layers. Does each layer have a different odor?

D. What is the reason for the differences and similarities?

So far you have helped your students:

--notice visually the differences in soil layers.
--contemplate the reason for variations.

WRAP-UP

SOLO SEARCH (30 minutes)

This is a final activity designed to have students investigate the surroundings for particular components of the environment.

A. Instruct students to go alone or in pairs and bring back the following things:

1. Evidence of man
2. Evidence of an animal
3. Something you think is good
4. Something you think is bad
5. Evidence of growth

B. When students return with specimens, encourage discussion of each item and what it means to the environment.

C. Use the items for natural art pictures (glue them on paper). Display the pictures in the classroom as a part of an environment interest center.

So far you have helped your students:

-- explore the area for specific evidence of influences
-- use the evidence to create art

PHYSICAL HISTORY STUDY AREA - Grades: 2-3

INVESTIGATING LOCAL GEOLOGY - 2½ Hours

OBJECTIVE:

1. To investigate the origin of local land forms and their contribution to the total environment.

2. To explore a well-defined sandstone micro-ecosystem.

MATERIALS NEEDED:

wet handiwipe in a plastic bag
baggies for rock collecting
magnets
tub of vinegar
flip chart
magic markers
balls of string
rulers
survey sheets
hand lenses
paper
pencils
5 gallons of water
plastic cups

I. GETTING TO KNOW THE AREA:

An awareness activity to stimulate interest in the rock and soil components in the area.

A. WASH YOUR HANDS WITH NATURE: (10 minutes)

1. As you are walking in the area, stop at various places and wash your hands with:

   -- the soil
   -- with a crumbly rock
   -- in the mud
   -- with a hard rock

2. Wash fronts, backs, sides, palms, fingers and wrists. Feel with the entire hand. This is a good way to compare different kinds of earth materials. (Use a wet handiwipe to clean hands after the activity.)

B. LIVING AT "AH-NEI": (20 minutes)

1. Individually, students are given 10 minutes to explore and find one object that would help them live or survive as early man at "Ah-Nei."

2. As a group, discuss the findings of the students.

3. Discuss the evidence of early man at this site. Prepare students to watch for evidence all day.

So far you have helped your students:

- Become aware of materials on the earth's crust.
- Focus on the interrelationship of early man and his physical environment.

II. INVESTIGATING A SANDSTONE MICRO-ECOSYSTEM:

Activities to help students explore the physical properties of land formations and their interrelationships as an ecosystem.

A. APPRECIATING ROCKS IN OUR ECOSYSTEM: (15 minutes)

1. Individuals select 5 rocks for studying as a group. Have them observe their own rocks':
    - shape
    - color
    - size
    - weight (use an equal arm balance for comparison purposes)
    - Is it attracted to a magnet?
    - Will it dissolve in water?
    - What happens when you put it in vinegar?
    - Does it scratch easily?
    - Will it break into pieces if you drop it from shoulder height?
2. What are some important things we could say about the rocks in this area. Discuss. (List on your flip chart and arrive at the word "sandstone.")

So far you have helped your students:

- Examine rocks for specific characteristics.
- Focus on the most common type of rock in this area.

B. HOW BIG IS AN ECOSYSTEM?: (15 minutes)

1. Divide the class in groups of 3 or 4. Each team may select their own sandstone outcropping for examining a rock ecosystem.

2. Around - Do a perimeter measure. Using string and 1' rulers, measure around the rock ecosystem. (Leave this string.)

   Across - Stretch a string.

   High - Use students as yardsticks.

So far you have helped your students:

-- Conceptualize "boundaries."

-- Improve their measuring skills.

C. COMMUNITY SURVEY - TRANSECT: (30 minutes)

1. In the same teams, throw a weighted string over the top of your outcropping, so it goes to the ground on the other side. Attach the string at the top and bottom.

2. Teams sample the life every foot and record data on the chart.

3. Before beginning, discuss what might be found in the rock community. (grass, soil, "lichen," shrubs, trees, bare rock, and animal evidence)

Sample	Grass	Soil	Animal Evidence	Lichen	Shrub	Tree	Rock
No. 1							
No. 2							
No. 3							
No. 4							
No. 5							
No. 6							
TOTALS							

4. Use a flip chart. Each team reports and data is compiled on a master chart.

   Looking at all that is there, create a drawing with students to show the sandstone micro-ecosystem.

D. THE STAKE OUT: (30 minutes)

1. While measuring your sandstone micro-ecosystem, you have established a perimeter. Within that perimeter, your team will look for the following:

-- a living thing
-- a non-living thing
-- colorful things
-- moving things
-- crawly things
-- a home
-- food
-- water
-- smooth things
-- rough things

2. Discuss the interrelationships of all those things listed. Let your students pretend to be one of the "things," and tell what "things" in the list they are important to, what is important to them, etc.

3. Sum up Community or Ecosystem discussion.

So far you have helped your students:

-- Focus on the elements found in an ecosystem.

-- Conceptualize "community" in the environment.

III. THE CLAY PIT: (30 minutes)

A concluding activity to sum up investigation of the Physical History Study Area.

1. Have students distinguish between clay and sandstone. Discuss. (Mudstones are mainly clays which have hardened into rock. Clays are fine-grained. Clays that form in lakes may show dark and light alternating layers called varves, each pair of layers representing a year's deposit. Unconsolidated clays are of tremendous value for ceramic and other uses. Clays are a mixture of silica, alumina, and water. Clay particles are small -- less than 0.0001 inch. They stick together but are slippery when moist. They can form from weathered shales which came mainly from clay minerals originally.)

2. Collect samples of clay. Examine it. Discuss present uses of clay. (bricks, tile, porcelain, and art)

3. Clay was used by primitive men to make pottery not long after they first began to use stones as tools and weapons.

4. Locate a clay pit. (Climb down the rim a bit.)

5. "Pretending we are 'early man,' living in this area, how would we use the clay?"

6. Using water, allow students to manipulate clay as Indians would. Objects should be taken back to school for painting and possibly baking.

7. Discuss your "early man" objects.

So far you have helped your students:

-- Develop an appreciation for early man's relationship with his environment.

-- Discover commercial uses for earth materials.

-- Use creative expression in the out-of-door environment.

PHYSICAL HISTORY STUDY AREA - Grades: 4-5

INVESTIGATING LOCAL GEOLOGY - 2½ Hours

OBJECTIVE:

To investigate the origin of local land formations and how they contribute to the total environment.

MATERIALS NEEDED:

50' guide rope
several 15' lengths of string
rulers
pencils
paper
plastic buckets or dishpans
large coffee cans
crayons
5 gallons of water
plastic baggies

I. GETTING TO KNOW NEW PLACES:

Preliminary awareness and interpretation to help students begin to focus on a particular part of the geology of this area. During this activity, the group is centered around a rock outcropping.

A. SENSING ROCKS: (15 minutes)

1. String a guide rope around a rock outcropping. With eyes closed, walk students in a line along the rope. Stop at selected places to emphasize sensing the system. Ask students to smell, listen, touch and taste the rock. Have students share impressions of each sense.

B. STRING-THING THE ROCK: (30 minutes)

1. Pairs of students receive 15 feet of string. Each team finds a place on the rock to run their stringline. Every 5 feet, the team must attach the string to something they think is interesting.

2. Encourage students to think their strings in, out, up, down, under, over, around, beside, crooked, straight, curved, etc.

3. Acting as guides, each pair takes the large group on a "tour" of its stringline, describing special things found on the outcropping.

So far you have helped your students:

-- Locate and focus on the components of a rock outcropping.

-- Use all their senses in exploring their environment.

II. WHAT IS A ROCK?:

Investigations designed to help students understand some basic geologic concepts, particularly those related to local environment.

A. SHORT DISCUSSION OF THE AREA: (15 minutes)

1. Geologically, the history of the earth is divided into time periods. Much of what we can see in this area was formed during the Cretaceous period, which ended approximately 60 million years ago. The Cretaceous period was part of the Mesozoic era. This area was probably shallowly flooded for the last time during this period. Dinosaurs roamed but were dying out. Early mammals and flowering plants were developing.

2. The types of rocks found here are called sedimentary. In this area, they are mainly sandstones and shales, with possibly some limestone.

3. Sedimentary rocks are generally formed three different ways:

   a. From the breakdown of older rocks, generally transported before it is deposited. This movement often gives round grains. Debris is eventually laid down in horizontal layers.

      (1) "Can you give me an example?" (sandstone)

      (2) "How would this breakdown occur?" (weathering, erosion)

   b. From chemical precipitates. (Interlocking crystals precipitated from solutions.)

      (1) "Can anyone give an example of a rock formed this way? The word crystal might give you a hint." (limestone)

   c. Formed from organic debris. (From remains of once-living organisms.)

4. "What other ways might rocks be formed?"

   (fire - heat - volcanic action - igneous rock)

   (changes in sedimentary or igneous rock occurring from heat, pressure, chemical action, etc., - metamorphic rock)

B. COLLECTING ROCKS: (30 minutes)

1. By yourself, find six seemingly different rocks for studying. Observe shape, color, size, and weight. Use an equal arm balance for comparison purposes. What does it taste like? Does it scratch easily? Will it break into pieces if you drop it from shoulder height? Return to the large group.

QUESTIONS AND DISCUSSION:

1. What did you find? Differences?

C. OBSERVING AND CLASSIFYING ROCKS:

1. Now, select one interesting rock from your collection. Discard the rest. Examine your own rock for 1-2 minutes and look for its observable characteristics.

2. Now each person share what they observed about the rock characteristics of their sample with other members of the group.

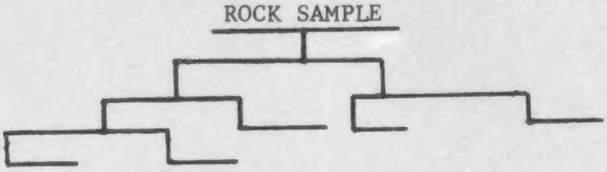
3. Put all of the rock specimens into 2 piles based on the major likenesses and/or differences of their characteristics.

4. Write down your reasons.

5. Ask the group to tell the reasons used, as you list on the board.

6. Your next task is to construct a dichotomous key. What does dichotomous mean?

7. Construct a dichotomous key using your own criteria for putting the samples into 2 piles. Divide each pile into 2 more piles of samples based on the major likenesses and differences of their characteristics. Continue dividing piles until you only have one specimen left.



8. Using the words in the key that describe the final sample, write a description of it in sentence form.

QUESTIONS AND DISCUSSION:

1. Have the group read its description.
2. Do you know more about the specimens now than when we started? We haven't done identification yet. Initially then perhaps names are not important until we are stimulated enough to find out the name. Now we are curious about all the specimen's characteristics. We also know some things about the principal kind of rock in this area.
3. We have used the classifying process in order to learn more about rocks. Could it be used for other things?
4. Discuss the value of classifying things in the environment.
5. Apply this to the classroom.
6. If we were exploring a variety of rocks, what would be some keys to sorting and recognizing their types? (size, shape, pattern, texture, color)

So far you have helped your students:

- -- Discover the types of rocks in the area and their differences from each other.
- -- Focus on the most common type of rock in this area.

D. MINI-MOUNTAINS: (30 minutes)

1. "What else can we learn from rocks? The earth is made of many kinds of rocks. We could imagine that a rock is a 'mini-mountain'."
2. In pairs, find a large rock (that can be carried and will fit in a dishpan). Bring it back to the group. Fill one dishpan of water from the 5-gallon bottle and place the rock in the other one.
3. Put your rock into the dishpan. Place a ruler in the pan, zero end down, and stand it up against the rock. (One person might hold it so it remains straight.)
4. Add water to the pan, until the water level reaches the one-inch mark on the ruler. When the water stops moving, use a crayon to mark the water level all around the rock.
5. Carefully add more water until the level reaches the 2-inch mark. Repeat, etc., until rock is covered with water.

QUESTIONS AND DISCUSSION:

1. What might the lines on our rock tell us? (The lines on the rock resemble lines on a contour map.) What do they tell you?

2. What do you notice about the distance between each line? The distance on the ruler between each line is called the contour interval. What does that mean?

3. Do you see different layers in your rock? How do they differ? What might have happened to cause them?

4. Which parts of the rock, if any, formed islands?

5. Where did valleys occur?

6. Which part or side of the rock had the gentlest slope? The steepest slope? Why?

7. What relationship can you find between the steepness of the slope and the distance between the contour lines?

8. How would all of this apply to comparing it to a large mountain or the general geography of the land?

So far you have helped your students:

- -- Understand that a variety of factors affect formations on the earth.
- -- Identify relationships between these factors and the earth.
- -- Conceptualize "contour."

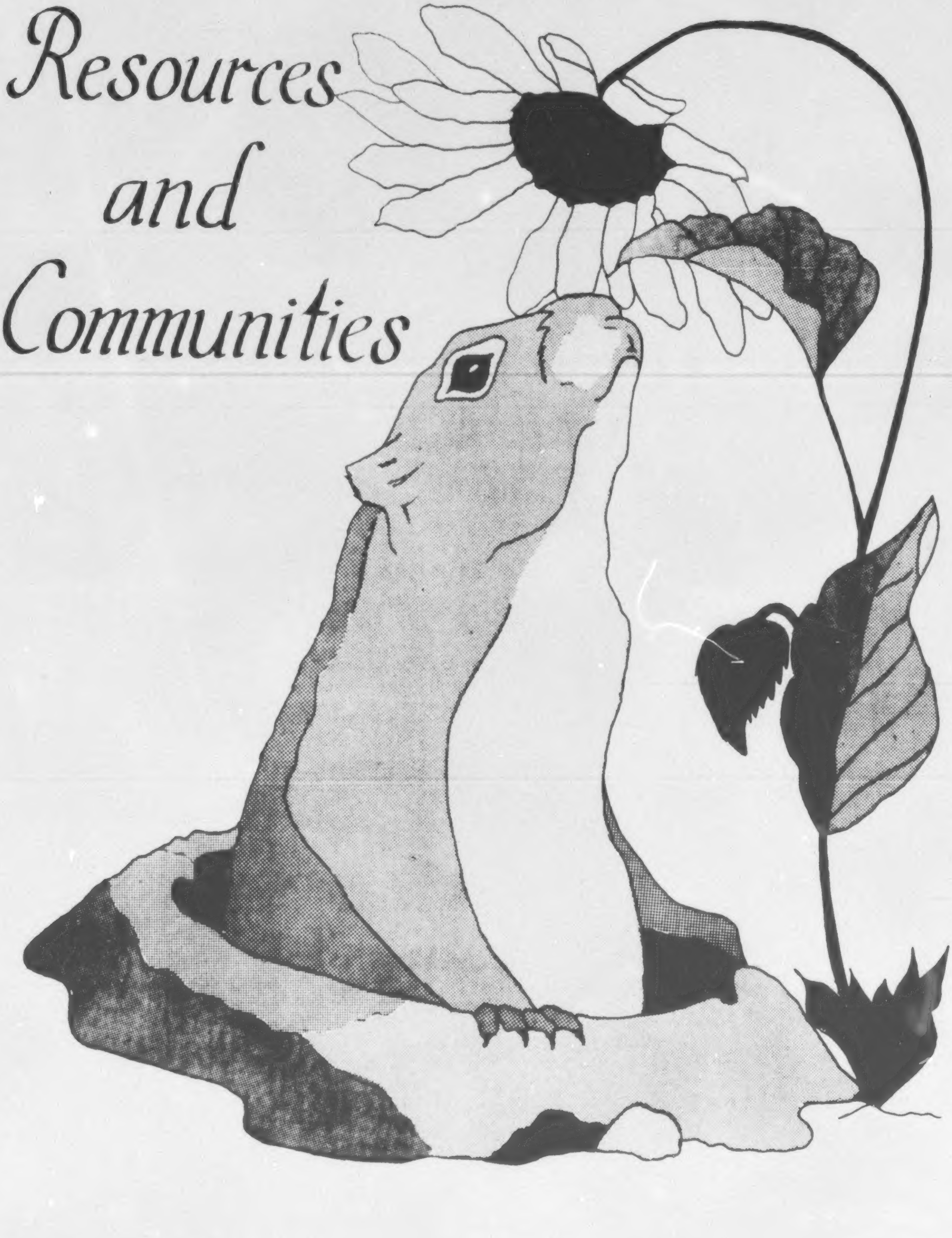
III. MY LIFE AS A "RIMROCK": (30 minutes)

A concluding activity to stimulate students' thinking about the physical history of this area and its importance.

1. Students are divided into three groups. Each group has 10 minutes to write a story about "My life as a 'Rimrock'."

2. Each group selects a person to share their story with the large group.

Resources and Communities



RESOURCES AND COMMUNITY - Grades: K-1

"THE FOREST COMMUNITY" - 2 Hours

OBJECTIVES:

Students identify components of a forest and "build" their own forest.

Be aware damage man causes by simply being in the forest.

Focus on a single tree as a resource and become familiar with it.

MATERIALS NEEDED:

- Spoons
- Paper
- Jugs or jars
- Charcoal or crayons
- Hand lenses
- Increment bore

I. "LET'S MAKE A FOREST": (45 minutes)

This activity is designed to have students focus on the components of a forest.

1. Have students in small groups of 4 or 5.

2. Discuss what is found in a forest. This should include:

    - Soils
    - Grasses
    - Shrubs
    - Wild flowers
    - Trees
    - Animals
    - Fox
    - Coyote
    - Porcupine
    - Birds, etc.
    - Pond
    - Stream
    - Hills and valleys

3. The children will use the material found on the ground and construct their own little forest. Use already broken twigs for trees, dead leaves and needles for shrubs, cones or other dead stuff for flowers. Look for unusual rock shapes to represent animals and use the spoons and jars of water to construct a pond and stream.

4. Imagine a boy and girl coming to your own forest for a picnic. What would change in your forest when people come? What things are destroyed? Emphasize care taken not to destroy the forest when we are working here at Ah-Nei.

So far you have helped your students:

- -- Identify the components of a forest.
- -- Use their creativity to build a forest from natural material found on the forest floor.
- -- Be aware of changes that take place with presence of man.

"WHAT'S A TREE?": (30 minutes)

An activity designed to have students investigate the tree as a part of the community.

DISCUSSION:

Ask your students to stand back from a tree and, by looking at it, tell everything they see:

Bark on trunk
Needles
Branches
Cones, etc.
Any homes for animals?

ACTIVITY:

Break your group up into smaller groups, pass out hand lenses to each and ask them to:

1. Hug the tree, be friendly, feel how big it is around, feel the rough bark, feel the needles, first on a branch then singlely, in your hand.
2. Smell the tree, put your nose in a crack of the bark and sniff. Smell the needles and branches. What does it smell like?
3. Taste the tree - open your mouth on the bark and taste it - chew a few needles. Would you use them for cooking if you were an Indian long ago?
4. Stand very quietly either hugging the tree or leaning against it. Make no noise yourself but listen to the tree. Does it whisper or sing or is it loudly thundering?

5. Ask the students if there is anything else they would like to know about the tree.

   1) How old is it?

   2) Why is it here?

      The teacher, using the increment bore, should bore the tree, explaining the long pencil - like piece of wood will tell them how old the tree is. Show them the dark lines and let the students count them using a hand lense if necessary.

   3) Why are some rings farther apart than others?

   4) Can you tell anything about the weather by the rings?

      Explain the climate for that year determines how much the tree will grow.

   5) What else happens to a tree that might possibly influence its growth?

      - Fire

      - Damage by animals such as porcupine chewing the bark, deer rubbing its antlers on the tree may break a branch.

      - Damage by man.

      Place the boring back in the tree. Eventually it will grow back into the tree.

So far you have helped your students:

-- Become familiar with a single tree by using all your senses.

-- Use inquiry and investigation to know more about a tree.

"COLOR THE BARK": (20 minutes)

This final activity allows the student to take a part of the tree back to the class room without damaging the tree physically.

1. Pass out paper and charcoal or crayons. Demonstrate how to place the paper on the bark and rub the charcoal over it, bringing out the texture. If crayons are used, take off the paper and use the sides for rubbing.

2. Take the rubbings back to the classroom and decorate the bulletin board with a tree with actual bark texture.

So far you have helped your students:

- Use their creativity to reproduce nature's original art.
- Take from the tree without damage to it.

RESOURCES AND COMMUNITIES - Grades: 2-3

THE COMMUNITY AS A WHOLE - 2½ Hours

An investigation of physical communities in the area and a correlation to man.

OBJECTIVES:

1. To investigate the components of a biotic community and their relationships.

2. To examine trees, as an example of natural resources in the area and some relationships to man.

MATERIALS NEEDED:

blindfolds
paper
charcoal
flip chart
magic markers
hand lens
11" x 11" cardboard sheets
12" strings
pebbles or pennies
masking tape
thumb tacks
soda straws
measuring tapes
flipchart graph

I. GETTING TO KNOW A TREE (30 minutes)

Introductory awareness in the forest community.

(Discuss being silent in order to hear directions)

1. Put on blindfolds to heighten other senses.

2. After a short spin (just like in pin-the-tail-on-the-donkey) to erase the sense of direction, guide each participant to a tree. Any tree.

3. Ask him to explore it.--Hug it. Rub his cheek against it. -- Listen to it--try to hear the life inside it, the sap running, the life breathing within. --Explore its "skin" with tongue, fingers, nose, his own skin.--Check out its base--where it grows. Is anything living on it?

4. After each gets to know his tree, lead them away again. Then, take the blindfolds off, return to the general area, and let each student try to find "his" tree. They probably will. Some make a beeline for it right away, some scratch their heads and run a gamut of tests--size, shape, texture, moss on the trunk--but they always end by patting the trunk and affirming: "THIS IS MINE!"

5. Using paper and charcoal, draw a portrait of your tree.

So far you have helped your students:

- -- become more familiar with the resource they will be investigating
- -- use creative expression in the out-of-door environment

II. CANVASSING THE COMMUNITY

Investigating activities to inventory and examine communities and resources in the area.

A. STUMP THE STUDENTS (60 minutes)

1. Succession from dead tree stage to where the log becomes part of the forest floor takes several years. What benefit is the rotting stump or log in the interim?

2. Discuss Succession.

3. Dead tree stages. How many might there be? (List on the flip chart.)

   How long would each stage take? Why do new stages occur?

   (Flip Chart)

   Stage I - Standing dead tree.
   Stage II - Newly fallen tree.
   Stage III- Log rotting inside.
   Stage IV - Completely rotten log.

4. Divide class in 4 groups. Each group is assigned a stage and finds a tree in this condition to examine. Directions as follows: (Each group should have a teacher)

   Stage I: Standing dead tree. Any bark on the tree? Is bark easily removed? Is wood hard and dry? Any invertebrates in bark or wood? Any wood borers? Record. Any fungi? Any moss or lichen? Is this a community? Why?

   Stage II: Newly fallen tree. Any bark? Is wood firm, soft, wet, or dry? Any invertebrates? Any borers? Record. Any fungi? Any moss or lichen? Is this a community? Why?

   Stage III: Log rotting inside, but hard on outside. Life off outer shell and examine contents. Break small part of shell and note all invertebrates. Rake through punky part - look for invertebrates and vertebrates (lizards, snakes, salamanders). Any fungi? Any moss, fungi, lichen? Is this a community? Why?

Stage IV: Completely rotten log. Rake through rotten log, noting all species and quantities. Is wood more moist or less so than a previous stage? Any fungi, moss or lichen? Is this a community? Why?

5. From the data your group collected, answer the following questions:

   What is the present environment of your particular dead tree as you view it?

   Does the tree, itself, do anything for the environment?

   What evidence is there that this tree supports life? If any, list.

   How will this life that is supported by the tree affect the tree?

   Is animal life dependent on the tree? If yes, what kind, how and why?

   Is plant life dependent on the tree? If yes, what kind, how and why?

   Is soil dependent on the tree? If yes, how and why?

   Is this tree an indicator of a life cycle? Illustrate, if it is, with a diagram.

   How could man best utilize this tree for his needs?

   What are the pluses and minuses for this tree to remain or not remain in the environment?

   Can you determine the age of the stump by using an increment bore?

6. Prepare a group report for the large group.

7. Hear group reports. Discuss.

8. Compare bark of dead tree with that of a live tree: color, texture, life.

9. Compare life of dead tree with that of live tree: food, shelter, kind of homes and species (plant and animal). Use hand-lens.

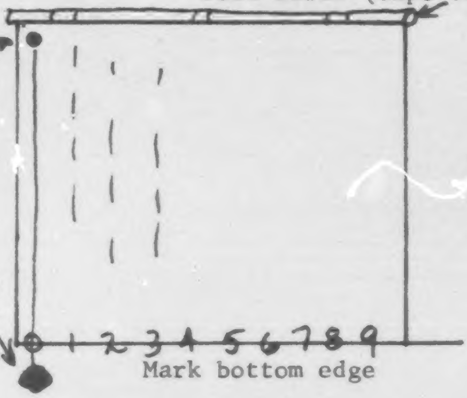
10. In which stage were the most kinds of animals found? In which stage were the most animals of all species found? What is the most striking physical difference between the first and last stage? Any kind of life found in all four stages?

So far you have helped your students:

- identify the stages of decay in trees
- become aware of the varied quality of life involved in the decomposition process.
- conceptualize "community."

B. STRANGERS IN THE FOREST (30 minutes)

1. Build a hypsometer.



Soda straw (tape to the top)

Attach a 12" string with a thumb tack

cardboard 11" x 11"

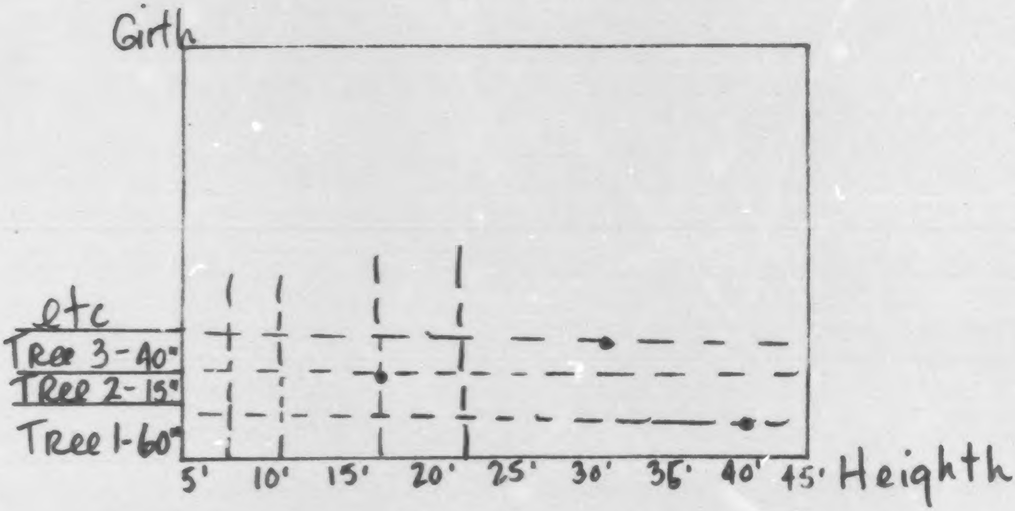
Weight the string with a penny or rock & masking tape

Mark bottom edge

2. Measure height of trees in the forest.

--Each student selects a tree to measure.
--Measure the distance from where you are standing to the base of the tree by pacing off feet. Record. (Teacher may demonstrate)
--Look through the straw on your hypsometer to the top of the tree. Record the number your weighted string lands on.

--Have the teacher help you multiply your distance figure by the weighted string number.
--Divide by 10.
--Add your height.
--You have the approximate height of the tree.
--Record your findings on the flip chart graph.
--Measure around the tree - chest high. List down left-hand side of chart.



Questions and Discussion:

1. Is your tree old, young?

2. Do you think trees grow the same as people?

3. Do trees grow around at the same rate as they grow up? Discuss the chart data. (Are all 15' trees the same distance around?)

4. What things do these trees need to live and grow?

5. Does man need the same things?

6. What happens if neither has enough of these things? (Boy in a crowded city; tree in a crowded forest.)

So far you have helped your students:

-- improve their measuring skills.
-- understand the use of graphs for data.
-- focus on biological needs of living elements in a community.

III. CINQUAIN - JAPANESE POETRY (30 minutes)

1. By yourself, find a favorite tree.
2. Sit under it. Ask it questions:
   Listen, touch, smell, taste, look.
3. Write the following:

   --Name your tree
   --Write 2 color words about it.
   --Write 3 action words about it.
   --Why do you like this tree?
   --Sum up your feelings in one word.
4. Return to the large group. Share your poems with the group.

So far you have helped your students:

- -- experience the physical environment by themselves
- -- bring about personal feelings about an element in the environment

RESOURCES AND COMMUNITIES - Grades: 4-5

MAN AND HIS ENVIRONMENT - 2½ Hours

OBJECTIVE:

1. To investigate an area in order to understand how man's activities enhances and degenerates biotic communities.

MATERIALS NEEDED:

magic markers
flip chart
tray of cards for surprise topics
paper
pencils
baggies
sketching paper
sketching charcoal
colored chalk
animal field guides
small animal field guides
vegetation field guides
sifters
trowels
increment bore
soda straws
stakes
flagging
jelly cups
soil testing kit
thermometers
wind vane
magnets

I. MAN CUTTING IN ON THE ENVIRONMENT

A. SURPRISE TOPICS (3o minutes)

1. The participants sit in a circle. A tray of cards, lying face-down, is passed among the participants.

2. Each person takes a card but may not look at the writing on it. The cards have words or short phrases on them such as "a cup of rain", "cattails", "dead twig."

3. As the facilitator randomly calls on a person, he must turn over his card and talk spontaneously about his topic's relationship to the environment. Continue until all the participants have had their turn.

So far you have helped your students:

-- be stimulated into thinking about elements in the environment.

II. INQUIRIES INTO THE ENVIRONMENT

Investigations to explore biotic communities and man's impact on them.

A. OBSERVING THE AREA (3o minutes)

1. Look around the area by yourself.

   -- What examples of impact do you see in this area? (Road cuts,off-the-road use, fire-wood cutting, etc. - man.)

   (Mounds, browsing, porcupine damage, etc. - animals)

2. Record your findings.

3. Return to the group.

Questions and Discussion:

1. What evidence is there that use of the land has undergone change?

2. What evidence is there that this area benefits several kinds of life?

3. What signs of interdependence are evident of animal to plant and animal to animal?

4. What physical properties are pertinent to life found in the area?

5. What erosion forces are evident in the area?

6. How is the plant and animal life in the area beneficial to man?

7. Is man getting the most use out of the area?

8. What are alternative uses of the area?

> So far you have helped your students:
>
> -- understand that impact occurs from all living things in the environment, including man.
> -- discover present uses of the area.

B. INVESTIGATING THE COMMUNITY: (30 minutes)

1. Divide the class in 4 groups. Each group will examine a specific component of the community.

2. The following field studies are completed in a site previously chosen by the teacher.

3. Field Studies for groups: (Each group should have teacher help if possible)

Group I

Animal Life (visible group - birds - rabbits, etc.)

(a) Take notes on kind - homes - types of food, color markings.

(b) Collect scat for further study.

(c) Record types of nests if possible - bird, mice, etc.

(d) Make sketching of area depicting the interrelationships of the environment.

(e) Take notes on habits - feeding, tracks to stream for drinking, etc.

(f) Identify species, if possible, use field guides.

Group II

Small Animal (worms, snails, insects, etc.)

(a) Take sample profiles of soil in the area to determine kind of insects, larvae and eggs found in the soil.

(b) Collect samples of flying and crawling insects and other small animals - Collect from soil - plants, etc.

(c) Identify by species - make a list - use field guide. Return animals to place where found.

(d) Make drawings where applicable - homes - nests, etc.

Group III

Plant Study - Overstory and Understory

(a) Take notes on population of trees - how many and what kind. List by species if possible, using guides.

(b) Take notes on age of the trees - determine with increment bore (take a sampling). Put collection in soda straws.

(c) Do an analysis of signature patterns on the rings of tree bore (no. of wet years vs. dry years)

(d) Do random plot studies of area - plots of 6 feet by 6 feet (2 on each side of stream). Identify each plant (Field guide) and amount of shade it occupies within the plot (percentage). Estimate amount of area in plot covered by litter (twigs, rocks and leaves).

(e) Determine predominant plants including trees - and smaller plants (figure on basis of shade and population).

(f) Collect small samples of lichens, mosses, fungi.

Group IV

Soil - Water - Air Field Activity

(a) Make profiles of the soil's horizons -- cross section of litter - duff - humus. Take notes on the life in the soil.

(b) Use soil testing kit to determine Ph. factor.

(c) Collect data on temperature and gauge the direction of wind.

(d) Study rock formation - determine kinds of formation - age - life, if any, etc. test minerals found with hardness kit (hardness - magnetism). Take notes.

4. Return to the large group.

172

C Examining the Community (30 minutes)

1. Hear group reprts on their findings. Ask questions of the group.

QUESTIONS AND DISCUSSION:

Using results and data from the field studies, re-discuss the following;

1. What evidence is there that use of the land has undergone change?
2. What wvidence is there that this area benefits several kinds of life?
3. What signs of interdependence are evident of animal to plant and animal to animal?
4. What physical properties are pertinent to life found in the area?
5. What erosion forces are evident in the area?
6. Hos is the plant and animal life in the area beneficial to man?
7. Is man getting the most use out of the ara?
8. What arealternatives for uses in the area?

2. On a flip chart with the large group;

- Do a list of benefits of the area.

- After each benefit, list and discuss cost factors. For example, in order to have hunting here, what impacts or "costs" are there?

- List the effects of man's activity on the area? Rate them.

- How could all uses of this area remain and still conserve the environment?

So far you have helped your students:

- develop an awareness of some of natuares phenomena and the role it plays in unique biotic communities.

- understand the impact of man's activities on biotic communities.

- conceptualize "multiple use".

III. Depicting our Community (30 minutes)

A creative activity to sum up feelings about the area we investigated.

1. In your same groups, make murals on the flip chart paper, showing the interaction and interdependence of life in the area and man's impact.

So far you have helped your students:

-- in a graphic form, conceptualize an eco-system.
-- use creative expression in the out-of-door environment.

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
COLORADO STATE OFFICE
ROOM 700, COLORADO STATE BANK BUILDING
1600 BROADWAY
DENVER, COLORADO 80202

IN REPLY REF
5-912
1790.8

August 24, 1973

"INQUIRIES INTO THE ENVIRONMENT"

LESSON PLAN: A Comparison of a north facing slope with a south facing slope 8500 ft. (Lower Montane Zone)

I. Objectives:

A. To develop an understanding of certain basic principles of ecology. (Life zones - toleration, community, etc.)

B. To involve students in interaction of ideas through discussion and field work.

C. To create an awareness of changes caused by alterations in environmental conditions.

II. Classroom Materials:

A. Slides of a north facing slope showing understory and overstory.

B. Slides of a south facing slope showing understory and overstory.

C. Discussion Questions:

1. How is vegetation different on these slopes?

2. How is vegetation similar on these slopes?

3. Which slope would best support animal life? Why?

4. Is there any evidence of animal life on these slopes?

5. How does the sun affect these slopes?

Do the following (6, 7, 8) by classification

6. What is the predominant tree or trees on each slope?

7. What is the predominant shrub or shrubs on each slope?

8. What are the predominant understory plants on each slope?

9. What climatic elements affect each slope?

10. Is there any evidence of disruption by man?

III. Field Study - Do as a whole group or class

A. Materials -

1. Field notebook.
2. Micro-bio gun for insect study.
3. Binoculars - for wildlife study.
4. Large tape measure for plot studies.
5. Field guides - Insects - birds - mammals - plants.
6. Increment bore - dating the tree and signature patterns.
7. Plastic bags for collecting.
8. Hand lens for minerals examination.
9. String and stakes for laying out plots.
10. Tools to measure board feet.
11. Straws for increment bores.
12. Thermometers to measure temperature.

B. Field Activities -

1. Make plot studies to differentiate plant and animal life.

a. One plot 66 ft. by 66 ft. on each slope. Identify each kind of plant. Identify kinds of animal life by examining the soil (plots 1 ft. by 1 ft.). Identify each. Record these in field notebook.

b. Do an increment bore on life of trees and analyze age and wet and dry years. Record in field notebooks. (Store in straws).

c. Identify rocks (Metamorphic - Igneious or Sandstone).

d. Study types of homes - holes - nests - trails, etc. Record materials used, where located, how protected from weather.

e. 5 plot studies - 1 meter by 1 meter. Identify plant life. Also animal life by doing 1 ft. by 1 ft. plots within the sq. meter. Record findings.

f. Record temperature and humidity in several areas on each slope.

g. Collect samples of life - scat, nests, etc.

IV. Post Field Activities:

A. Answer questions presented on slides. A set to each student.

B. Comparison of answers to questions - those before the field trip and those after the field trip.

C. Make charts on similarities and differences found on a north facing and south facing slope.

1. Predominant plants.

2. Predominant animals.

3. Chart life of trees with historical highs in human life.

D. Draw mural of animal life found on each slope - with key telling characteristics of each.

E. Draw mural of trees and shrubs found on each slope with key for characteristics.

F Draw mural of understory plants with key for characteristics.

G. Other unique ideas presented by students.

V. Alternate Methods:

A. Do field activities in small groups.

B. Minimize activity according to teacher's discretion.

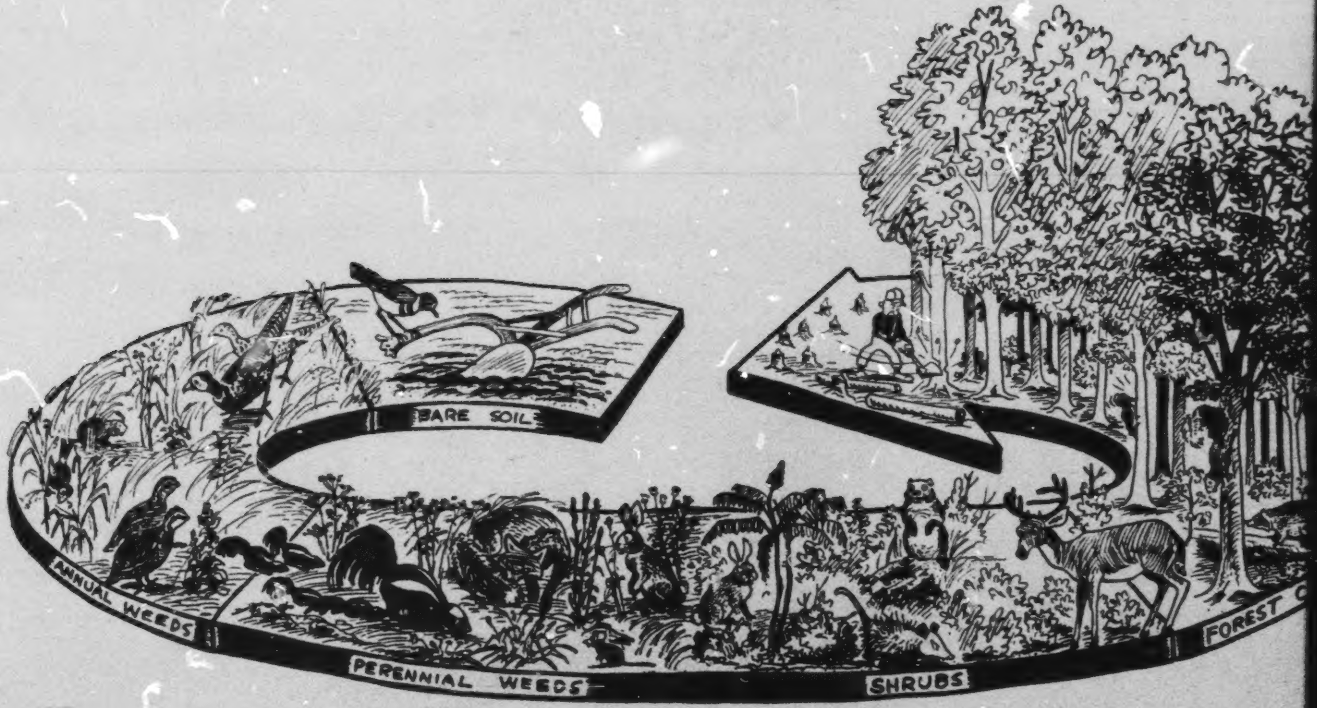
C. Do one activity in the field at a time - spread field activity over several days.

D. More interest activities - soils study, degree of slope, weather analysis, etc.

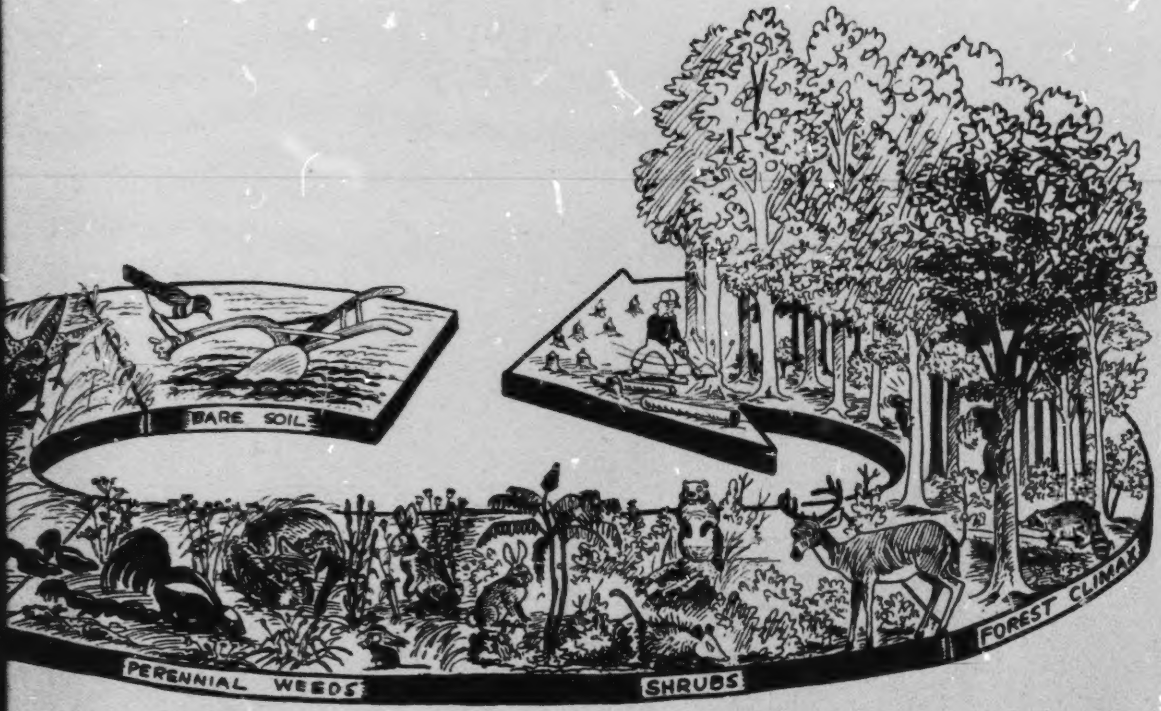
E. Apply with each life zone.

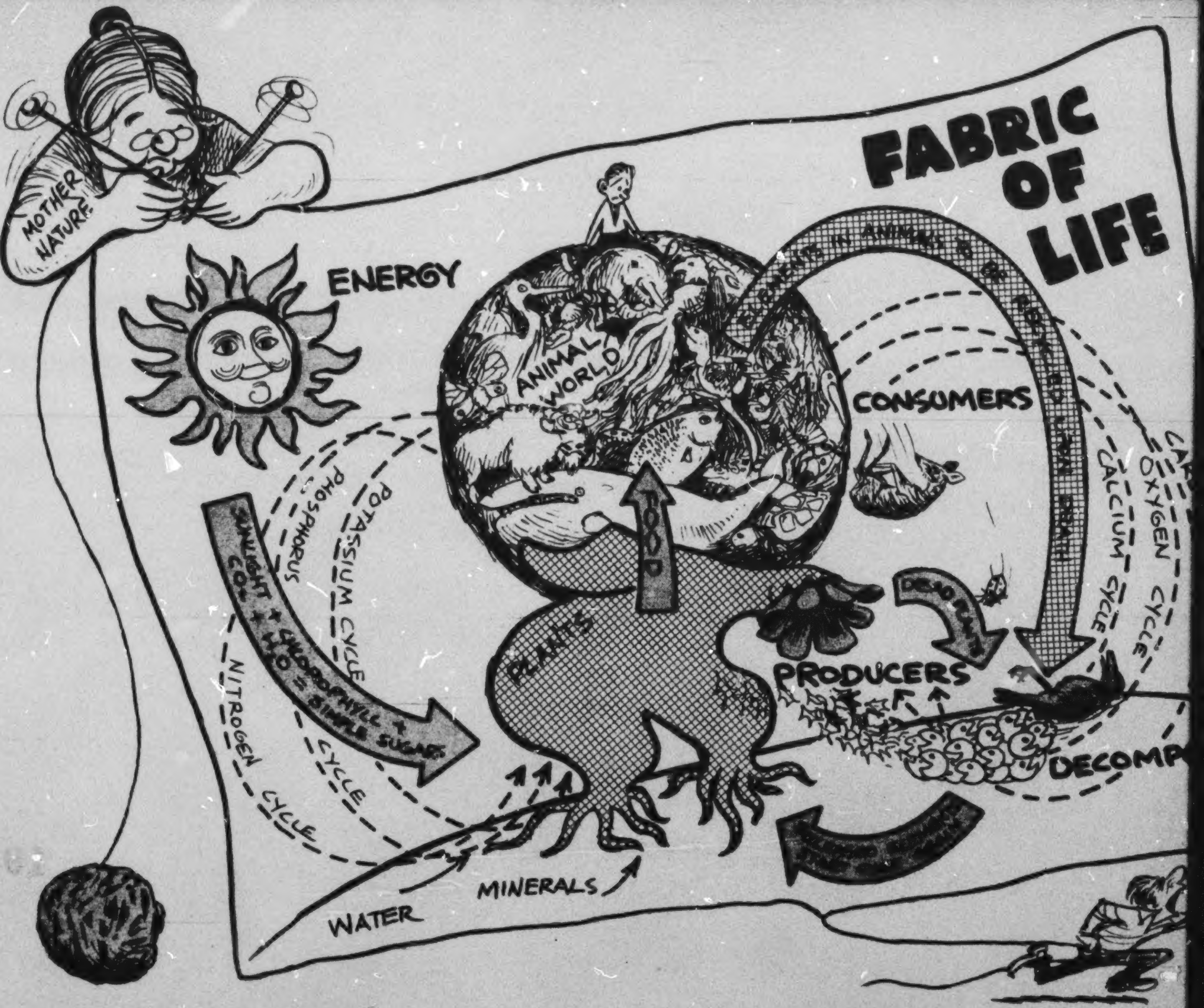
NOTE: Depth of study will depend on sophistication and interest of students or group.

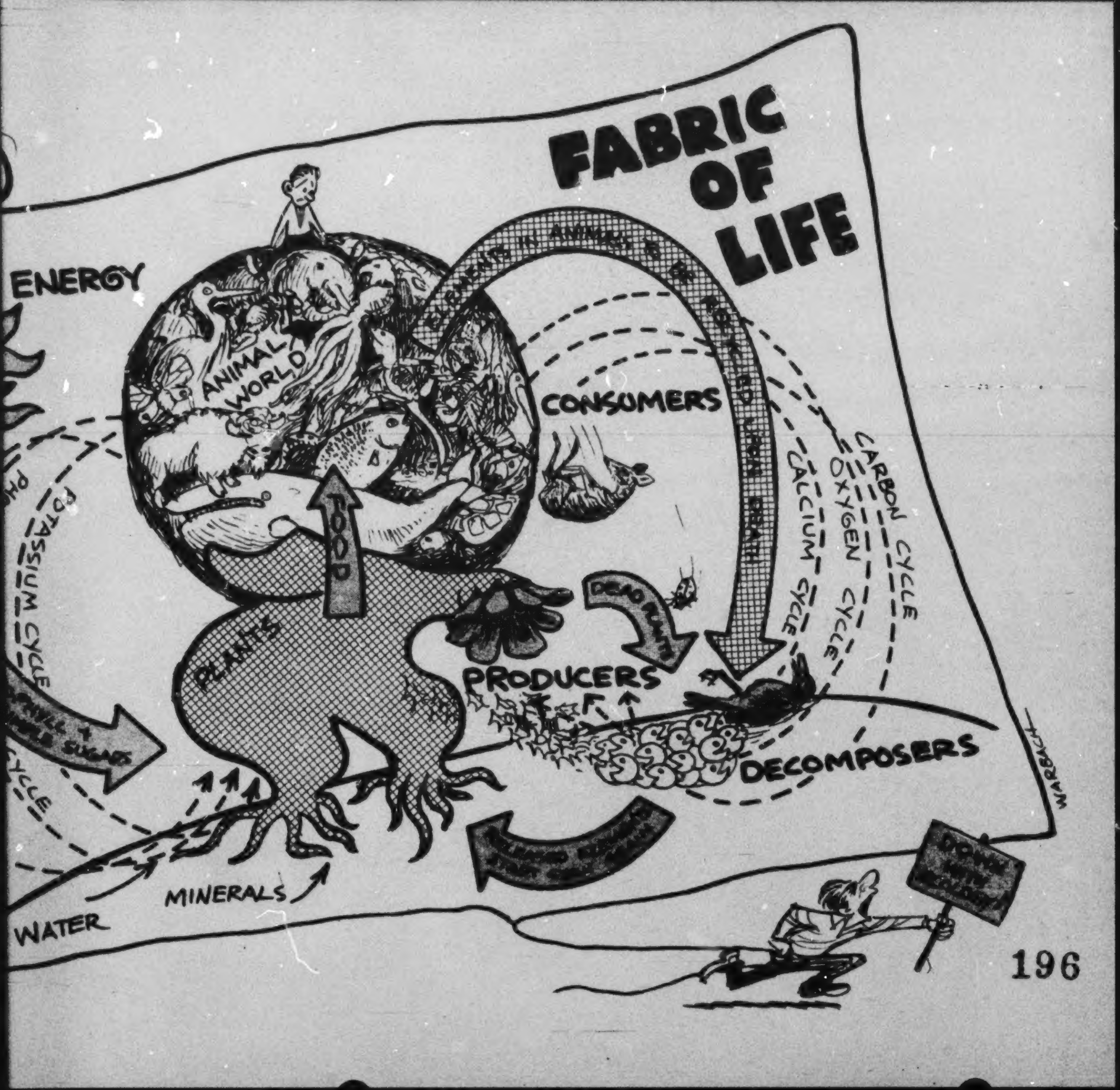
This lesson plan was prepared by Jack Pyle for the Bureau of Land Management. Any suggestions for alteration of the plan would be appreciated.



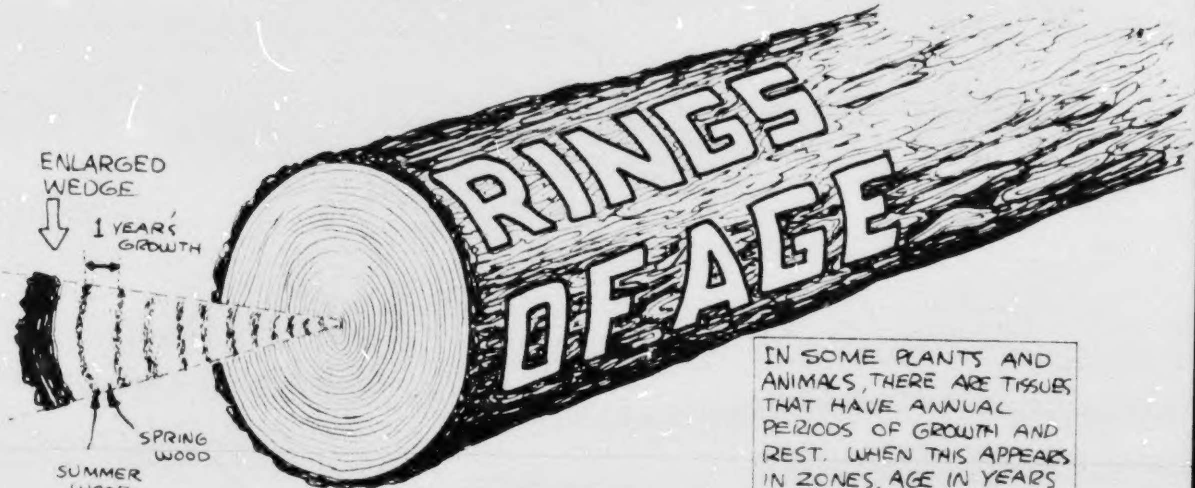
193


BARE SOIL
PERENNIAL WEEDS
SHRUBS
FOREST CLIMAX


FABRIC OF LIFE
MOTHER NATURE
ENERGY
ANIMAL WORLD
CONSUMERS
SUNLIGHT + CHLOROPHYLL + CO_2 + H_2O = SIMPLE SUGARS
PHOSPHORUS
POTASSIUM CYCLE
NITROGEN CYCLE
CYCLE
FOOD
PLANTS
DEAD PLANTS
PRODUCERS
CALCIUM CYCLE
OXYGEN CYCLE
CA
DECOMP
MINERALS
WATER


FABRIC OF LIFE
ENERGY
ANIMAL WORLD
CONSUMERS
FOOD
PLANTS
DEAD PLANTS
PRODUCERS
DECOMPOSERS
CARBON CYCLE
OXYGEN CYCLE
CALCIUM CYCLE
POTASSIUM CYCLE
SUGARS
CYCLE
MINERALS
WATER
WARBACH
UPON DEATH

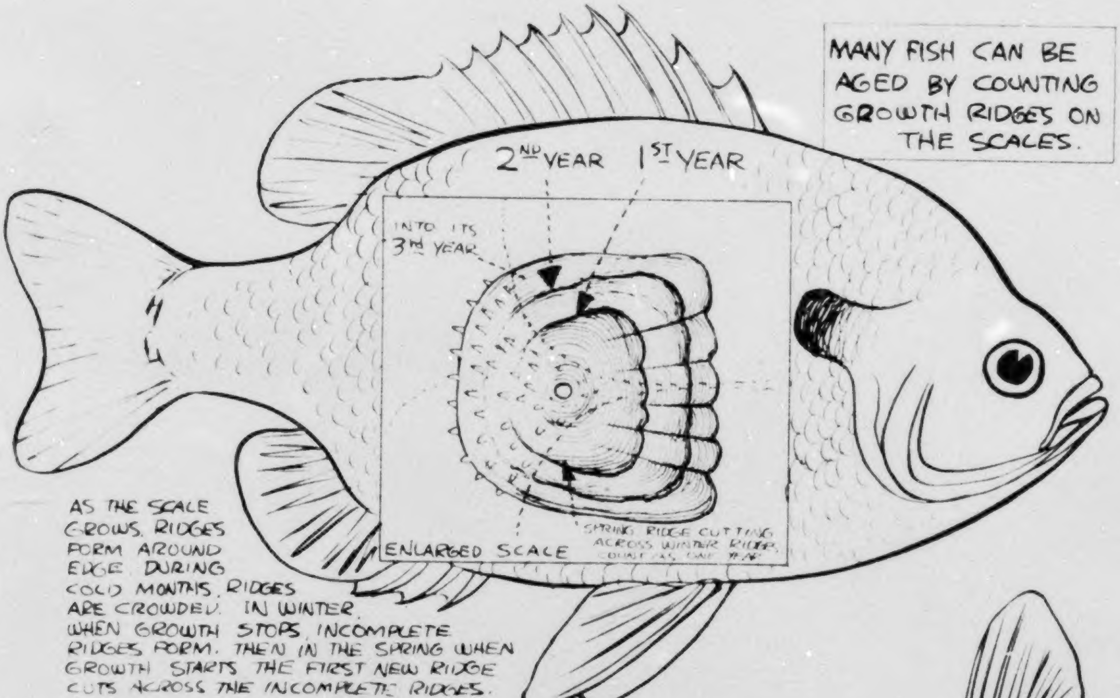
RINGS OF AGE



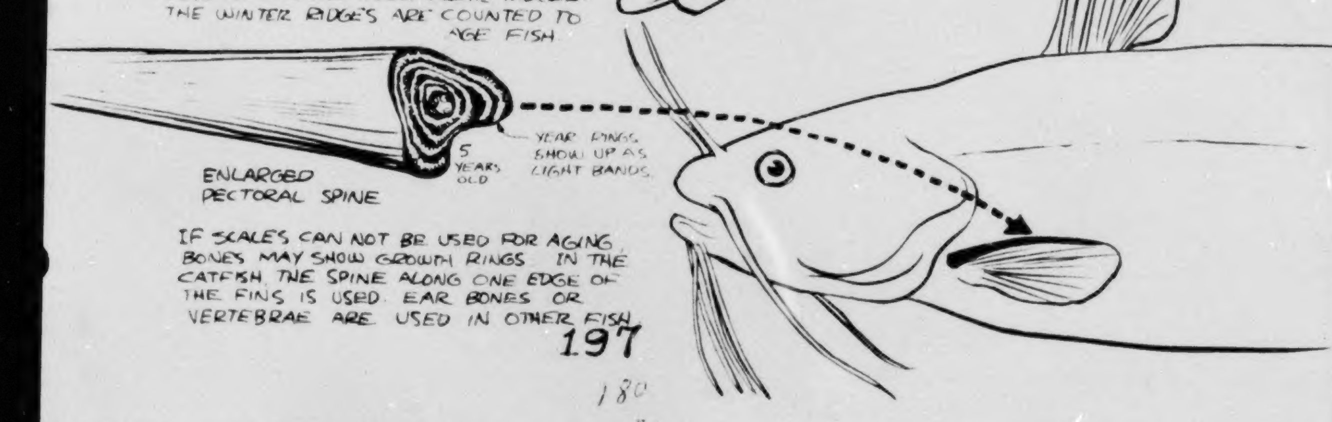
DARK RINGS IN THE TRUNK CAN BE USED TO COUNT AGE IN MOST TREES. RINGS ARE EASILY SEEN IN ASH AND OAK; DIFFICULT TO SEE IN SWEET GUM AND SOFT MAPLE.

IN SOME PLANTS AND ANIMALS, THERE ARE TISSUES THAT HAVE ANNUAL PERIODS OF GROWTH AND REST. WHEN THIS APPEARS IN ZONES, AGE IN YEARS CAN BE DETERMINED.

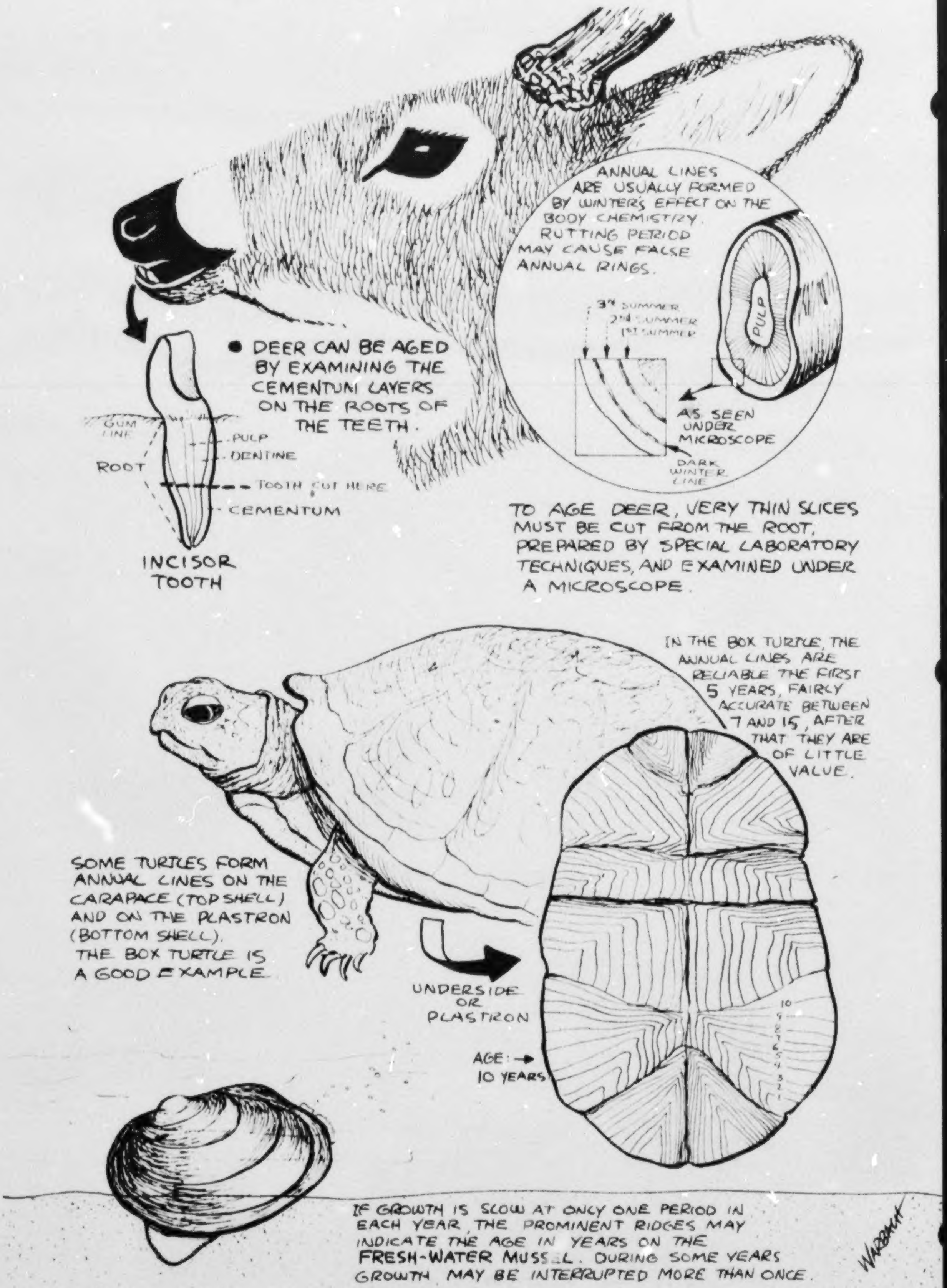
MANY FISH CAN BE AGED BY COUNTING GROWTH RIDGES ON THE SCALES.



AS THE SCALE GROWS, RIDGES FORM AROUND EDGE. DURING COLD MONTHS, RIDGES ARE CROWDED. IN WINTER, WHEN GROWTH STOPS, INCOMPLETE RIDGES FORM. THEN IN THE SPRING WHEN GROWTH STARTS THE FIRST NEW RIDGE CUTS ACROSS THE INCOMPLETE RIDGES. THE WINTER RIDGE'S ARE COUNTED TO AGE FISH.



IF SCALES CAN NOT BE USED FOR AGING, BONES MAY SHOW GROWTH RINGS. IN THE CATFISH, THE SPINE ALONG ONE EDGE OF THE FINS IS USED. EAR BONES OR VERTEBRAE ARE USED IN OTHER FISH.



- DEER CAN BE AGED BY EXAMINING THE CEMENTUM LAYERS ON THE ROOTS OF THE TEETH.

ANNUAL LINES ARE USUALLY FORMED BY WINTER'S EFFECT ON THE BODY CHEMISTRY. RUTTING PERIOD MAY CAUSE FALSE ANNUAL RINGS.

TO AGE DEER, VERY THIN SLICES MUST BE CUT FROM THE ROOT, PREPARED BY SPECIAL LABORATORY TECHNIQUES, AND EXAMINED UNDER A MICROSCOPE.

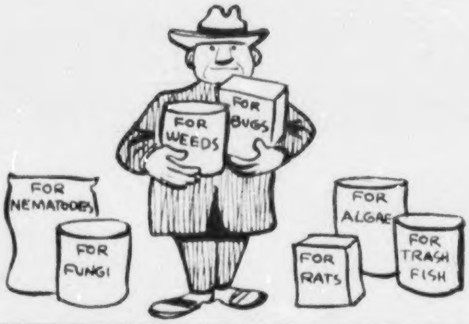
IN THE BOX TURTLE, THE ANNUAL LINES ARE RELIABLE THE FIRST 5 YEARS, FAIRLY ACCURATE BETWEEN 7 AND 15, AFTER THAT THEY ARE OF LITTLE VALUE.

SOME TURTLES FORM ANNUAL LINES ON THE CARAPACE (TOP SHELL) AND ON THE PLASTRON (BOTTOM SHELL). THE BOX TURTLE IS A GOOD EXAMPLE.

IF GROWTH IS SLOW AT ONLY ONE PERIOD IN EACH YEAR, THE PROMINENT RIDGES MAY INDICATE THE AGE IN YEARS ON THE **FRESH-WATER MUSSEL**. DURING SOME YEARS GROWTH MAY BE INTERRUPTED MORE THAN ONCE.

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

PESTICIDE PRIMER



PESTICIDE : A CHEMICAL USED TO CONTROL OR DESTROY UNWANTED PLANTS OR ANIMALS.

SHORT-LIFE PESTICIDES : THOSE WHICH BREAK DOWN RAPIDLY.

EX: MALATHION IN DAYS
METHOXYCHLOR IN MONTHS

"HARD" PESTICIDES : THOSE WHICH REMAIN UNCHANGED FOR LONG PERIODS OF TIME IN THE ENVIRONMENT (YEARS FOR DDT)

OTHER EXAMPLES: ALDRIN, DIELDRIN, ENDRIN, CHLORDANE, LINDANE, AND HEPTACHLOR.

MOVEMENT OF PESTICIDES : WATER, WIND, DUST, AND ANIMALS HAVE MOVED HARD PESTICIDES TO ALL TYPES OF ENVIRONMENTS IN ALL PARTS OF THE WORLD TO AREAS WHERE THEY HAVE NEVER BEEN USED.

EX. ANTARCTIC

SELECTIVE PESTICIDES : CHEMICALS THAT AFFECT TARGET SPECIES ONLY.

EX.-LAMPRICIDE - KILLS ONLY LAMPREY LARVAE.
PYRETHRUM - KILLS INSECTS, BUT NOT BIRDS.

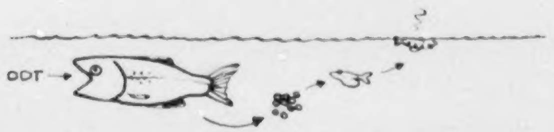
BROAD-SPECTRUM PESTICIDES: CHEMICALS THAT AFFECT MANY SPECIES:

EX: DDT, MALATHION

DIRECT KILL : SOME PESTICIDES ARE TOXIC ENOUGH TO KILL SOON AFTER TREATMENT.

INDIRECT KILL: LETHAL EFFECT OF LONG-LIFE (HARD) PESTICIDES SHOW UP SOME TIME AFTER APPLICATION - EVEN IN THE NEXT GENERATION.

A. THROUGH EGGS



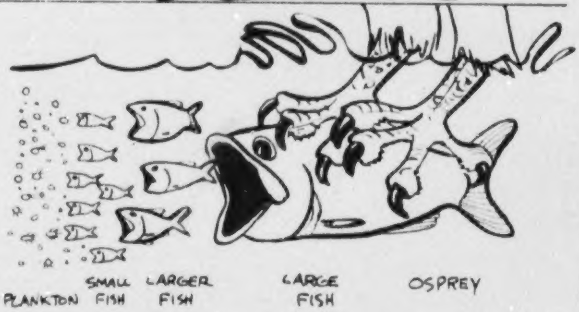
DDT PASSED ON FROM MOTHER TO EGG TO YOUNG KILL THE FRY.

B. THROUGH EFFECT ON REPRODUCTION.

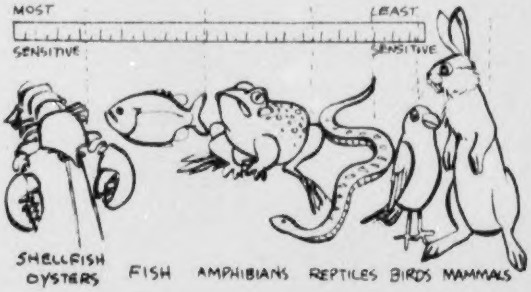
EGGS FAIL TO HATCH

C. THROUGH FOOD - YOUNG DIE FROM EATING CONTAMINATED FOOD.

BIOLOGICAL MAGNIFICATION: SMALL AMOUNTS OF "HARD PESTICIDES CAN ACCUMULATE TO LARGER AMOUNTS THROUGH THE FOOD CHAIN.



BIOLOGICAL VULNERABILITY: LIVING ORGANISMS VARY IN THEIR RESISTANCE TO PESTICIDES.



STORAGE: SOME PESTICIDES ARE STORED IN TISSUES OF LIVING ORGANISMS.

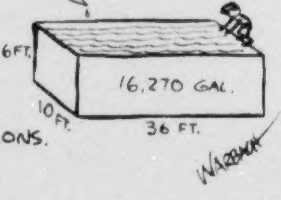
EX. · DDT IN FAT

OTHER PESTICIDES IN CARROTS, POTATOES, RADISHES

I WONDER HOW MUCH OF THIS IS DDT?

P.P.M. - PARTS PER MILLION
P.P.B. - PARTS PER BILLION
} TERMS USED TO STATE DILUTION OF PESTICIDES IN ENVIRONMENT AND IN ORGANISMS.

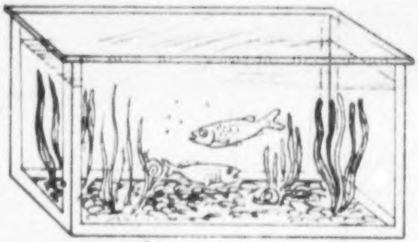
EX. LESS THAN 1 P.P.B. OF ENDRIN CAN KILL SHRIMP. THAT'S ONE DROP IN ABOUT 16,270 GALLONS.


6 FT.
16,270 GAL.
10 FT.
36 FT.

WARBACH

ECOLOGY PRIMER

ECOLOGY- THE STUDY OF HOW LIVING THINGS RELATE TO ONE ANOTHER AND TO THEIR NON-LIVING SURROUNDINGS.

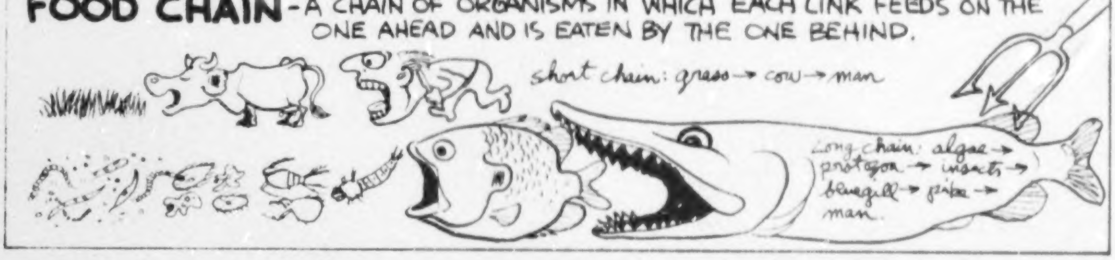


example: balanced aquarium

example: a prairie

ECOSYSTEM - ALL THE LIVING AND NON-LIVING THINGS IN A GIVEN AREA THAT HAVE SELF-RENEWING RELATIONSHIPS.

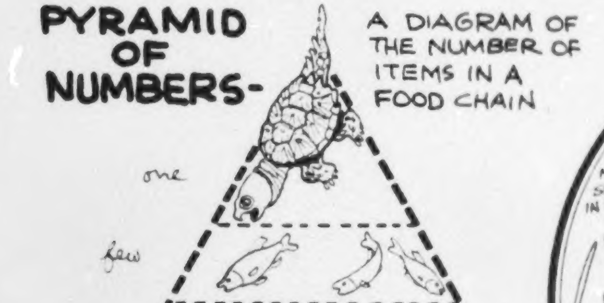
FOOD CHAIN - A CHAIN OF ORGANISMS IN WHICH EACH LINK FEEDS ON THE ONE AHEAD AND IS EATEN BY THE ONE BEHIND.



short chain: grass → cow → man

Long chain: algae → protozoa → insects → bluegill → pike → man.

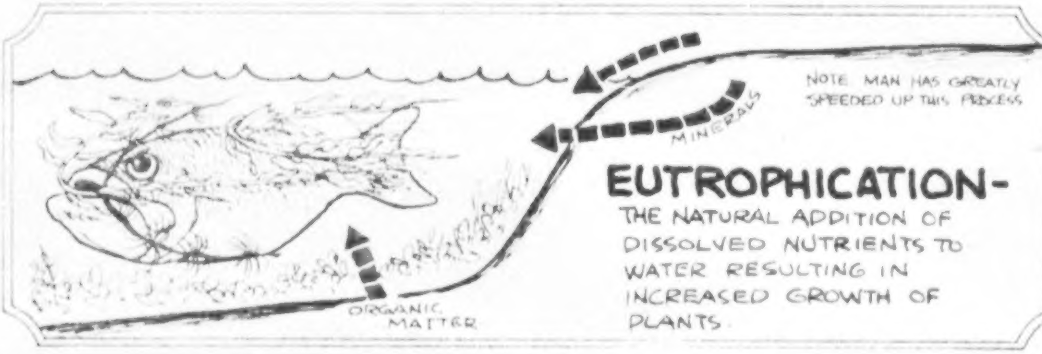
PYRAMID OF NUMBERS- A DIAGRAM OF THE NUMBER OF ITEMS IN A FOOD CHAIN



NICHE - (pronounced "NITCH") A "JOB" AT A PARTICULAR PLACE IN THE NATURAL COMMUNITY.

EX: PRAIRIE DEER MOUSE AS A SEED EATER IN THE PRAIRIE.

184


ORGANIC MATTER
MINERALS
NOTE MAN HAS GREATLY SPEEDED UP THIS PROCESS

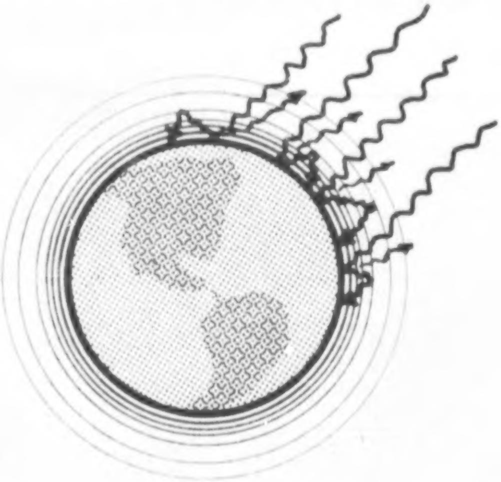
EUTROPHICATION-

THE NATURAL ADDITION OF DISSOLVED NUTRIENTS TO WATER RESULTING IN INCREASED GROWTH OF PLANTS.

EX: THE PRAIRIE CHICKEN "WORRIES" WHEN BRUSH AND LITTLE TREES REPLACE HIS GRASS.

PLANT SUCCESSION-

WHEN ONE GROUP OF PLANTS REPLACES ANOTHER.

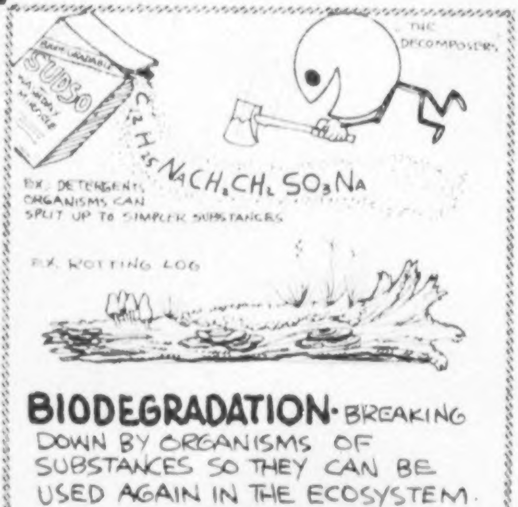


GREENHOUSE EFFECT-

THE TRAPPING OF SOME OF THE SUN'S HEAT RAYS BY REFLECTION FROM GASES IN THE ATMOSPHERE.

CARRYING CAPACITY-

THE MAXIMUM AMOUNT OF PLANTS AND ANIMALS THAT AN ECOSYSTEM CAN SUPPORT CONTINUOUSLY.


SUDSO
THE DECOMPOSERS
$C_{12}H_{25}NaCH_2CH_2SO_3Na$
EX: DETERGENTS ORGANISMS CAN SPLIT UP TO SIMPLER SUBSTANCES
EX. ROTTING LOG

BIODEGRADATION-

BREAKING DOWN BY ORGANISMS OF SUBSTANCES SO THEY CAN BE USED AGAIN IN THE ECOSYSTEM.

WARBACH

STORIES FOR FREE CHILDREN

SAVE THE EARTH!

AN ECOLOGY HANDBOOK FOR KIDS

by Betty Miles/illustrated by Claire A. Nivola

People share one earth: the land, the seas, and the thin layer of air around them, warmed by the sun.

The earth is always changing. The land shifts, air and water flow in changing patterns. Plants and animals and people live and grow and die. These are natural changes.

People change the earth, too. They live on it, use up parts of it, study it, spoil it, or learn to understand it.

When people work to clean up the water and the air, to preserve wild lands, plant trees and plan cities, learn to care about ecology, they begin to save the whole earth.

Every person can help to save the earth. You can.

SAVING THE LAND

People can save the land. They can plan to use land wisely instead of wastefully; plan to save trees when they build new homes; plan space for green parks and playgrounds in their cities and suburbs; plan to keep some of their wild land forever wild.

People can learn to use the energy of the sun and wind, instead of stripping the land for energy-producing coal.

They can farm the land carefully, using crops that make the soil rich instead of using it up, and setting out plants as barriers against the erosion of wind and rain.

They can learn to use things over and over—to recycle them—so that there is less trash to throw onto the land; and they can learn to turn trash into landfill or building materials, instead of piling it in ugly dumps.

Open space, and pleasant, useful land is everyone's right. People can demand and enforce laws that save the land.

PROJECTS ABOUT LAND

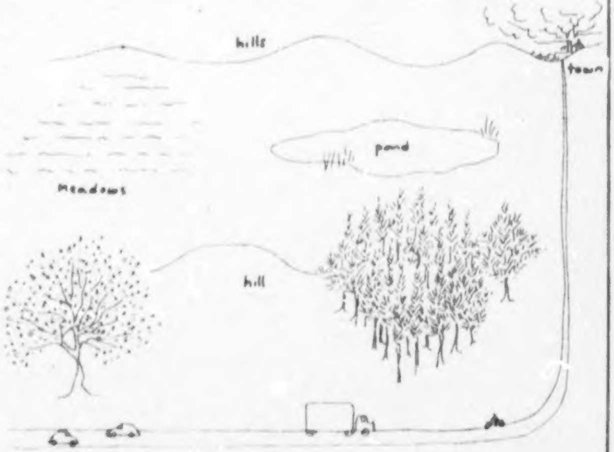
1 *Planning New Town:* Three hundred people will live in New Town—people of all ages, from new babies to very old people.

New Town will have one-family houses, apartment houses, an elementary school, some stores, a community center, and a town office building.

You can try out different plans for New Town. Use pennies for houses, nickels for apartment houses, quarters for larger buildings. Use toothpicks for roads. Move them around while you think about these questions:

How can the land be divided into enough space for living without cutting down all the trees on it now?

How can people get from one house to another, and to school and the stores, without having to cross busy streets? Without having to use a car for every trip?



How much space could be saved for open land? For swimming? A playground and park for children and old people? Or other things you think of.

Condensed from Save the Earth! An Ecology Handbook for Kids by Betty Miles, illustrations by Claire A. Nivola, by permission of Alfred A. Knopf, Inc. Copyright © 1974 by Betty Miles.

2 *No Bag, Please:* Everyone knows that when you save paper, you save trees that would have to be cut down to make new paper. So—take your own bag when you go shopping.

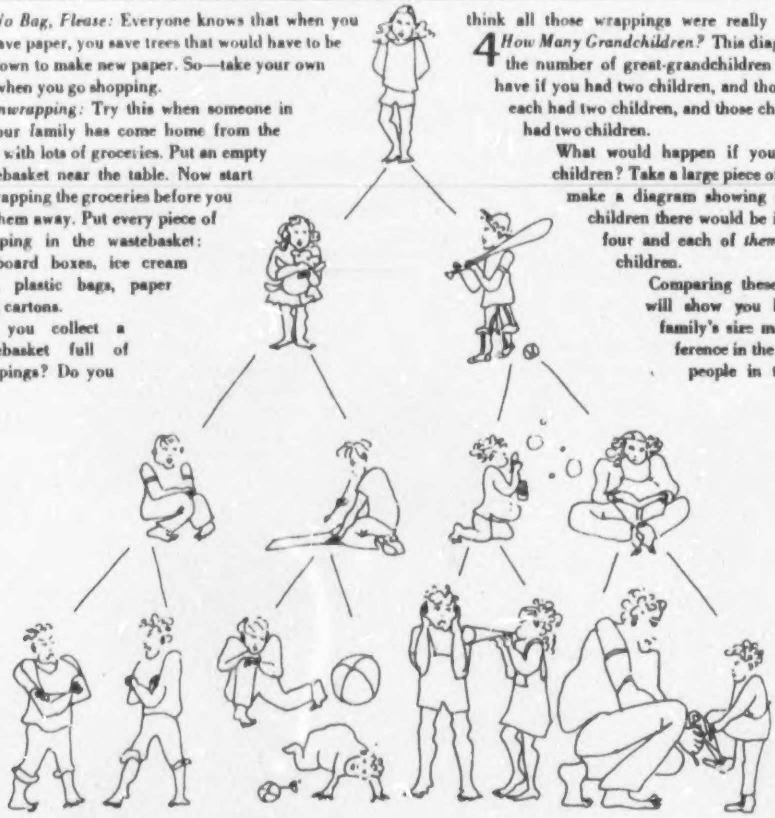
3 *Unwrapping:* Try this when someone in your family has come home from the store with lots of groceries. Put an empty wastebasket near the table. Now start unwrapping the groceries before you put them away. Put every piece of wrapping in the wastebasket: cardboard boxes, ice cream bags, plastic bags, paper bags, cartons.

Did you collect a wastebasket full of wrappings? Do you think all those wrappings were really necessary?

4 *How Many Grandchildren?* This diagram shows the number of great-grandchildren you would have if you had two children, and those children each had two children, and those children each had two children.

What would happen if you had *four* children? Take a large piece of paper and make a diagram showing how many children there would be if each had four and each of *them* had four children.

Comparing these diagrams will show you how every family's size makes a difference in the number of people in the future.



SAVING THE AIR

People can save the air.

They can cut down pollution from car exhausts by adding emission-control devices to all cars, by making smaller cars that burn less fuel—or by using fewer cars. They can arrange car pools, and find ways of moving more people with less pollution, like trains, buses, moving sidewalks, neighborhood taxi-buses. And, of course, bicycles.

People can learn to recycle waste without burning it. They can control factory pollutants before they leave the chimneys.

People can stop noise pollution by cutting their own noise down, and developing quieter machines. They can enforce rules against unnecessary noise.

Clear air is everyone's right. People can demand and enforce laws that keep it clean.

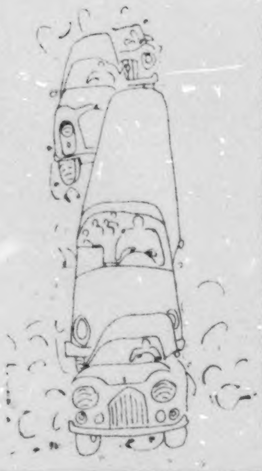
PROJECTS ABOUT AIR

1 *Catching Pollution:* Spread a thin layer of Vaseline on some pieces of cardboard. Put the pieces outdoors in different places: on your front step, on a windowsill, or taped to the outside of the window, fastened to a tree, or to a building near a busy corner.

A day later, check your cardboards. Whatever is stuck to each piece is a record of one day's pollution in that place.

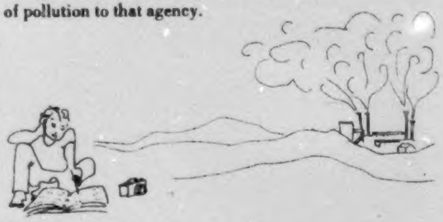
2 *Car Exhaust:* Put a white sock over the exhaust pipe of a car that has been parked for a while so the pipe is cool. Step back. Ask the driver to turn the engine on and then to turn it off.

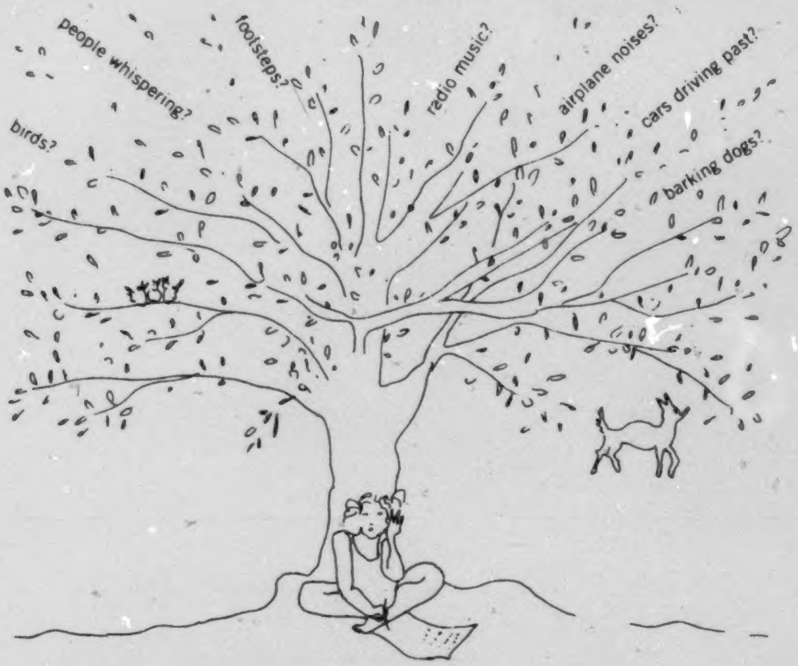
Pull the sock off the exhaust pipe carefully (the pipe may be hot) and look inside the sock. The pollution in the sock is just part of the pollution you breathe from one car's exhaust. (Some of it is invisible.)



3 *Pollution Detective:* If you see a factory near you polluting the air with clouds of soot and smoke from its smokestacks, you can make a record of the pollution to prove it. Every day for a week, at the same time of day, stand in exactly the same place, and take a photograph of the factory. Write down the day, the time, and the place in your notebook. When your pictures are developed, you will have proof of the pollution.

Now, find out what agency in your town or city is in charge of controlling air pollution and take your evidence of pollution to that agency.




people whispering?
footsteps?
radio music?
airplane noises?
cars driving past?
birds?
barking dogs?

4 *The Quietest Place:* Take a pencil and a piece of paper and go to the quietest place you know—a room in your house, or the library, or maybe some outdoor place. Now, be very quiet yourself and listen. What do you hear?

Write down every sound you hear, and see how long a list you have made. Most "quiet" places have a steady hum of noise, but people get so used to it that they don't really hear it unless they listen carefully. In really noisy places, the noise is so loud you *have* to hear it. Having to listen to noise takes energy, and that's why noise can make you tired.

SAVING THE WATER

People can save the water.

They can plan ways to recycle water, collecting it after use and using it over and over again.

They can plant crops that hold water in the land, make laws against poison sprays that run off into water, and save open marshes and swamps that are giant natural reservoirs.

They can protect fish and birds and the health of people by making laws to keep factories from dumping their waste and trash into streams and rivers and oceans.

Clear, fresh water is everyone's right. People can demand and enforce laws that save the water.

PROJECTS ABOUT WATER

1 *Water Count:* As soon as you get up in the morning, put a little notebook and a pencil in your pocket. All day long, make a note *every* time you use some water.

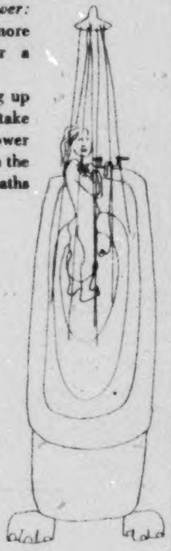
Don't forget. At the end of the day, see how long your list is. Are you surprised at how many different ways you have used water? How many gallons do you think you used? (Every flush of a toilet takes eight gallons of water.)

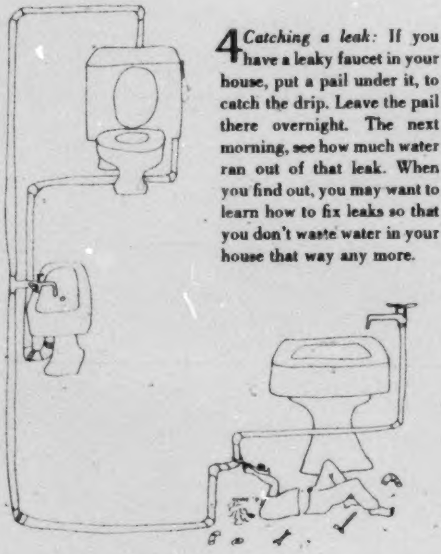
2 *Catching Rain* When rain is predicted, put a pail outside your house to catch some of it. After a day measure the depth of the water in the pail. The number of inches (or the part of an inch) you have measured is the rainfall rate for that day where you live.

If you have caught a lot of rainwater, save it to use later.

3 *Bath or Shower:* Which uses more water, a bath or a shower?

To find out, plug up the tub drain and take a shower. Is the shower water you caught in the tub as deep as the baths you usually run?





4 *Catching a leak:* If you have a leaky faucet in your house, put a pail under it, to catch the drip. Leave the pail there overnight. The next morning, see how much water ran out of that leak. When you find out, you may want to learn how to fix leaks so that you don't waste water in your house that way any more.

ADD IT UP

Every day, enough waste is thrown out in the United States to make a five-pound pile for every single person in the country.

Every day, every person alive uses 6,000 gallons of air, just breathing in and out.

Every day, people use enough water in homes and business and institutions to add up to 150 gallons for every single person in the United States.

It isn't easy to change the way you do things, or the way your family does them. Remember, changing to even one good ecology habit is a start. And it is a good idea to try changing your own ecology habits before you go to work on projects with other people. You'll find all kinds of resource information in the *Ms.* "Gazette" on page 119.

Betty Miles, who teaches at Bank Street College of Education, has written many children's books. Her novel for young people, "The Real Me" (Knopf), was published this fall. Claire A. Nivola is a painter and sculptor. She also illustrated "The Disobedient Eels" (Pantheon).

INVESTIGATING AN ENVIRONMENTAL ISSUE

THE "QUICKY WAY"

Working with another person, read the article and then fill out the following items:

A. Impact of Issue (circle appropriate words)

				WHY
Local	*None*	*Some*	*A Lot*	
Regional	*None*	*Some*	*A Lot*	
National	*None*	*Some*	*A Lot*	

B. List some groups or individuals that would be interested and/or affected by this issue.

1.
2.
3.
4.
5.
6.
7.
8.

C. List at least 4 additional things you want to find out about this issue and how you see collecting and recording the information.

THINGS TO FIND OUT	*WHERE TO FIND*	*HOW TO RECORD*
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

D. List the major factors that you feel are affecting the issue at present and describe how you could change the factor to bring about a change in the issue.

U. S. Forest Service
Ogden, Utah

Factor	*How you could change it to bring about a change in this issue (eliminate it, substitute something else for it, or modify it*
1.	
2.	
3.	
4.	
5.	
6.	

E. List at least 3 possible courses of action to bring about an improvement or solution to the issue.

1.

2.

3.

4.

F. Select one or two courses of action and list some possible consequences

	BENEFICIAL EFFECTS	*HARMFUL EFFECTS*
TO ENVIRONMENT		
TO SOCIETY		

G. Develop a plan of action for one solution that your group selected.

ACTION PLANNING FOR PROBLEM SOLUTION

SUGGESTED ALTERNATIVE SOLUTION	TYPE ACTION NECESSARY TO ALTER CONDITION	CHANGE AGENTS	IMPLEMENTATION STEPS TO PROBLEM SOLUTION
____________	______________________	______________	_________________
____________	______________________	______________	_________________
____________	______________________	______________	_________________
____________	______________________	______________	_________________
(Write in Solution suggested by your group in Task D)	**Technological** What kinds of technological action would be necessary to implement this idea? **Social** What kinds of social action would be necessary to implement this idea? **Political** What kinds of political action would be necessary to implement this idea?	**Individual** What kinds of things could be done through individual action? **Groups** What kinds of things could be done by/through groups? Informal Formal (organizations) **Agencies** What kinds of things could be done by/through agencies?	(What must be done?--in what order?--when? **Steps** **Target Date** 1. 2. 3.

Summary questions:

1. What did you find out?
2. How will the selected solutions contribute to the improvement of the environment?
3. What can we say, in general, about environmental management?

. Develop a plan of action for one solution that your group selected.

ACTION PLANNING FOR PROBLEM SOLUTION

SUGGESTED ALTERNATIVE SOLUTION	TYPE ACTION NECESSARY TO ALTER CONDITION	CHANGE AGENTS	IMPLEMENTATION STEPS TO PROBLEM SOLUTION	EVALUATION METHODS
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
(Write in Solution suggested by your group in Task D)	**Technological** What kinds of technological action would be necessary to implement this idea? **Social** What kinds of social action would be necessary to implement this idea? **Political** What kinds of political action would be necessary to implement this idea?	**Individual** What kinds of things could be done through individual action? **Groups** What kinds of things could be done by/through groups? Informal Formal (organizations) **Agencies** What kinds of things could be done by/through agencies?	("What must be done?--in what order?--when") **Steps** **Target Date** 1. 2. 3.	

Summary questions:

1. What did you find out?
2. How will the selected solutions contribute to the improvement of the environment?
3. What can we say, in general, about environmental management?

SAMPLE ARTICLE

'Possum population on increase

By JAN CHRISMAN

of The Oregonian staff

Population problems don't plague people alone.

Take opossums, for instance.

Those ratlike creatures not only eat almost anything and live nearly anyplace, but they also breed anywhere — and often. No sense of monogamy. Never heard of Planned Possumhood.

That's why the proliferating 'possum population is provoking Portlanders in greater numbers than ever.

The furry animals were unknown in Oregon until the 1930s when, as the story goes, some were released from a Civilian Conservation Corps camp at Warrenton, where they were kept to supply Southerners with 'possum stew.

There is no 'possum census, but the animals are definitely on the increase, even in downtown Portland, said Lloyd Smith, Oregon Game Commission information expediter.

In the past few years there have been local tales of 'possums discovered munching zinnias and chrysanthemums, hiding in a tavern's bowling machine, holing up in the hood of a car and biting a woman's toe while she lay in bed.

Driver attacked

One attacked a young man on the back of the neck while he was driving. Another ate two kittens in a garage.

Most frequently, however, the 'possums have been reported as automobile accident victims, usually hit as they cross roads at night.

One reason for their abundance is their indiscriminating taste in shelter and foods. Although some animals can live only in certain climates, 'possums are quite adaptable to a variety of conditions. Unlike some finicky beings, they eat anything from berries, insects, mice and birds to squirrels, rabbits and chickens.

Besides that, Madame 'Possum may deliver six to 16 young after a gestation period of only 14 to 17 days — which means rapid replacement for the deceased.

Although they generally are regarded as pests by most humans, 'possums do have a few uses. Their flesh can be eaten. Their pelts occasionally are sewn together and worn. In 1943 a University of Oregon Medical School professor reported that he found young 'possums useful in a study of hearing development.

They play dead

They've also provided the "playing 'possum" model for feigning unconsciousness in unpleasant situations. And they've amused some with their upsidedown hanging ability — a talent usually lost as they mature and their bodies become too heavy for their tails to support.

'Possums, like many animals, said Graziella Boucher of the local Animal Defenders League, "have been very much abused."

"I feel sorry for any animal that doesn't feel wanted. They make delightful pets when they trust you," she said.

Even the Animal Defenders League, however, agrees that the 'possum population should be controlled — not because they are pests, but to save them from human cruelty.

Miss Boucher favors a mobile unit program that would provide spaying for 'possums and "all female animals that are mingling with the public."

She advises persons who find 'possums on their property to "see that they are fed and watered."

Mike Burgwin, assistant manager of Multnomah County Animal Control, takes a different stance. The control staff, which also receives 'possum queries referred by the Humane Society, advises callers to "leave the possum alone unless it bothers them," he said.

Pesky 'possums are exterminated by Animal Control, he said, because "nobody wants 'em dumped on their property."

If dumped in a field, a 'possum would probably "land on another one" to breed anew, he added.

With about 50 teeth, 'possums are hardly cute or cuddly. They are "quite vicious," with a sharp bite, Burgwin said.

However, they are "pretty clean" and are not common carriers of rabies, he added.

Should the 'possum population continue to increase, "something serious" may have to be done, he said.

That "something serious," he explained, might be the declaration of a " 'possum clunking day" when all citizens would be asked to go out and kill all the 'possums they find in a certain area.

Apparently, it's a choice between spaying 'possum, clunking 'possum, letting alone 'possum or arousing dogs, foxes, coyotes, bobcats and great-horned owls, the natural enemies of 'possum.

A LESSON PLAN OUTLINE FOR INTERPRETING THE LANDSCAPE IN A FOREST ENVIRONMENT

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example: In the next four hours we are going to make some inferences of why we think some things are the way they are based on observations; test out those inferences by experimentation, collect and interpret past events in this experiment, and explore ways that we can improve the efficiency of energy cycles. (You might want to read the behavioral objectives at the end of the lesson and refer back to them as evaluation of the session.)

The following activities may help you look for observable changes, relationships, patterns and trends, in order to interpret past events, understand present relationships, and indicate future trends in the forest environment.

The processes used in this lesson plan can be replicated in any environment. Some of the activities used cannot. In environments other than a forest, you may have to develop activities appropriate to the area.

I. OBSERVING AND INFERRING WITH CROSS SECTIONS. (as an example of using observable evidences to infer past events in a forest)

Distribute cross sections and task cards. Cross sections of trees can be 4-6" in diameter or larger, and should show a variety of growth patterns and influences (fire, insects, etc.).

> TASK A: (on cards)
> (5-10 minutes)
>
> Work with 1 or 2 other people.
> Write down some things you notice about the cross sections.

Questions and discussion:

1. What are some things you noticed about the cross sections? (Accept all comments from group. List on board or chart.)
2. Focus on 2 or 3 items for discussion:
   Why did you say....(your crossection had evidence of fire)? (examples)
   What could account for....(the rings being irregular)?
   What are some things that could account for....?

Investigating Your Environment Series
U.S. Forest Service
Portland, Oregon

1974

TASK B: (on cards)
(10 minutes)

Work with 1 or 2 other people.
Select 3 observations about the cross sections from the group list.
List possible reasons for these observations.
List ways you could set up an investigation to find out more about your observations and inferences.

Observation (What You Noticed)	Inferences (Possible Reasons For This)	Investigations (How We Could Find Out)
1.		
2.		
3.		

Questions and discussion:

1. Ask for reports on the above chart from several groups. (as time allows)
2. Which of these investigations could be carried out in this environment?
3. Keep your lists of observations and inferences for reference at the end of this session.
4. What could tree rings from this forest tell us about past and present events in this environment?

II. COLLECTING AND INTERPRETING DATA ABOUT TREE GROWTH RATE AND COMPETITION

Task C (with tree cores) requires preparation by the instructor before the session.

A tree stand should be selected for study, 4-5 trees tagged (trees should be selected that show effects of environmental conditions--injury, overcrowding, lack of sunlight, etc...). The tagged trees should be bored with an increment borer, by the instructor ahead of time. (Cores should be numbered corresponding to numbers on the tree. Putting tree cores in see-through plastic straws and then taping to a cardboard will help keep them longer if liquid resin is not available. In any event, keep the cores and labeled trees to use again. This eliminates the necessity of reboring the trees.

NOTE: Maybe you can find and use stumps of trees that grow under a variety of competition influences instead of tree cores.

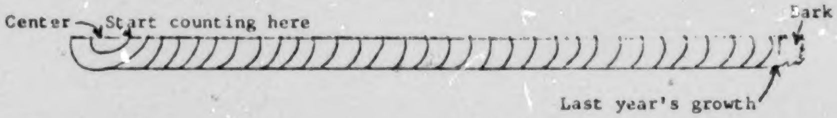
TASK C: (Part 1) (15-20 minutes) Work in groups of 4-5 people

1. Observe the tree core your group has been given and record the following information: (See drawing of tree core to help interpret the tree core you have been given.)

Tree #	# Dark Rings From Center to Bark (Approx. Age)	# Dark Rings in Last Inch	Remarks about the pattern of the rings

2. When your group has the above information, one person from the group should record this information on the blackboard or easel board. Chart to be like TASK C, part 2.

DRAWING OF TYPICAL TREE CORE



(Part 2) (10-15 minutes) Work in small groups

Record the following information about tree cores from the master chart. (Instructor will provide the diameter information.)

Tree #	# Dark Rings From Center to Bark (Approx. Age)	Diameter of Tree Trunk (Cir. ÷ 3)	# Dark Rings in Last Inch	Remarks about the Ring Pattern
1				
2				
3				
4				
5				
6				

Questions and discussion:

1. What similarities do you notice in the data about the trees?
2. What differences do you notice in the data about the trees?

TASK C: (Part 3) (20-30 minutes) Work in small groups

Set up an investigation to find out reasons for some of the differences in the data.

1. Select 2-3 trees from the list that show differences in growth rates.
2. Which trees did you select? (Indicate by number)__________________
3. Why did you select these trees?____________________________________
____

Go with your group to the site of the trees you selected for investigation and do (Part 4)

(Part 4) (30-40 minutes) Work in small groups.

Collecting and Recording Data
Record your observations:

Interpreting Data
Record possible interpretations of the above data:

Summarizing your Investigation
Write your group's summary below, including:
what you were trying to find out
what data you collected about it
what interpretations you made
what other data would you collect about your investigation?

Questions and discussion:

1. Ask for 2-3 minute summaries from several groups. (as time allows)
2. What problems did you encounter in this task?
3. What other data could you collect about your investigation?
4. What does the information tell us about the past events of this environment?
5. How would you summarize the major factors affecting the growth of this forest?

III. INTERPRETING PAST EVENTS

TASK D: (30-40 minutes)

Look for evidence of change (natural and man-made) in the environment. Record and fill out other columns.

Evidence of Changes in the Environment	What Might Have Caused Them?	Effect on the Environment

Describe the way the area around you looked:

25 years ago

Describe how you think the area around you might look:

25 years from now

Questions and discussion:

1. What evidence of change did you find?
2. What might have caused this?
3. What was the effect of ________(this change) on the environment? Allow time for interchange of ideas between group members. The same changes may have been noticed, and there may be many interpretations of their causes and their effects.
4. What do you think this area looked like 25 years ago?
5. How do you think this area will look 25 years from now?

TASK E: (10 minutes)

Describe in writing how you feel about the changes in this environment.

IV. INFERRING CHANGES IN A ROTTEN LOG OR STUMP

Find a rotten stump or log
Questions and discussion:

1. What things about this stump give us clues about the past events that have taken place?
2. What factors caused these things to happen?

TASK F: (15-20 minutes) Work in groups or by yourself.

NOTE: DO NOT TEAR THE STUMP APART! Discuss why.

What things are changing the rotten stump now? Record below:

*Living things	Effect on Stump
*Non-Living things	Effect on Stump

Questions and Discussion:

1. What cycles are taking place in the rotten log or stump?
2. In the space below, construct a diagram of one of the cycles taking place in the rotten log or stump:

TASK G: (15 minutes) Work in groups.

Construct a diagram of one of the cycles taking place in the rotten log or stump.

V. TRANSFERRING THE PROCESS TO OTHER ENVIRONMENTS

Questions and Discussion:

1. What are some other things in this environment that could help us further interpret the landscape and what it can tell us about the landscape. List on board.
2. Using one of the items listed in one or another you can think of, do TASK H.

TASK H: (30 minutes)

Describe in writing an alternative activity you could have done to establish a time sequence for the past events in this environment.

Describe in writing an activity you could do in a city environment to establish a time sequence for the past events in the environment.

Activity	What it would tell you about the past events in the area

Describe an activity you could do in the area around your school to establish a time sequence for the past events in the area.

Activity	What it would tell you about the past events in the area

VI. COMMUNICATING FEELINGS OF AWARENESS THROUGH SKETCHING

Distribute sketching paper, and pieces of charcoal from a campfire or fireplace.

TASK I: (give these directions verbally)
(Use sketching paper)
Construct a sketch using charcoal from a campfire or fireplace.
Other sketching materials will be given to you as you work.

NOTE: Subject of sketch depends on the environment.
It can be anything that is significant about the area....
rotten log, stump, or snag
an old homestead, fence, or barn
a city building, transmission tower, or freeway

While people are sketching, go around and give them:
rotten wood - brown   dandelion leaves - green   dandelion flowers - yellow
other goodies, in season
If you're not in the woods, IMPROVISE!

VII. COMMUNICATING FEELINGS OF AWARENESS AND VALUES THROUGH WRITING

Note: Begin this part when about half the people finish their sketch.

TASK J: (give these directions verbally)

Use your pencil or pen.
Find a place on your sketch (across the bottom, or down the side) to write some things.

Write 2 descriptive words about the stump.
(words that tell what it looks like)

Write 3 action words about the stump.
(words that describe processes or changes taking place, or things happening to it)

Write a short phrase (4-5 words) that tells how the stump affects the rest of the environment. (a phrase to describe its value or usefulness) (or a phrase describing any thought you have about the stump)

Write 1 word that sums up everything about the stump.
(a word that suggests a comparison, an analogy, or synonym)

Optional:
Now, if you wish, go back and give a title to what you have written.

Congratulations. You have just written a poem about the stump or whatever you wrote about.

Note: Pace the above directions to the needs of the group.
People shouldn't feel pressure while writing this -- be casual.
(It's good to mention that they may not wish to write something for every direction that is given.)
Review the directions now and then for people still thinking.

Have people read their writings if they wish.

Question to think about:
In what ways does this description show your feelings and awareness of the environment?

SUMMARY QUESTIONS

1. What did we find out about the environment in our session today? (list on chart, if time)
2. Why are these things important to the way we manage the environment?
3. How can we summarize our discussion? (or investigation)
   (What are some big ideas that would sum up what we've just said?)
4. What methods and processes did we use in our investigations?

TASK K

5. Describe in writing how you feel about our session today.

BEHAVIORAL OUTCOMES IN KNOWLEDGE

As a result of these activities, you should be able to:

List at least 3 observations about the cross sections provided, and infer possible reasons for each observation.

Describe ways to set up an investigation to find out more about the above observations and inferences.

Set up an investigation (collect and record data) to find out reasons for growth rate differences in a given stand of trees.

Describe activities appropriate to other environments for interpreting the landscape.

Identify and list at least 3 evidences of change in the environment, and infer the cause-and-effect relationships of those changes.

Construct a diagram of a cycle in a rotten stump.

BEHAVIORAL OUTCOMES IN FEELINGS, AWARENESS, VALUES, AND ACTION

As a result of these activities, you should be able to:

Describe how you feel about one change in this environment.

Communicate feelings of awareness by constructing a sketch of a given object in the environment, using natural materials.

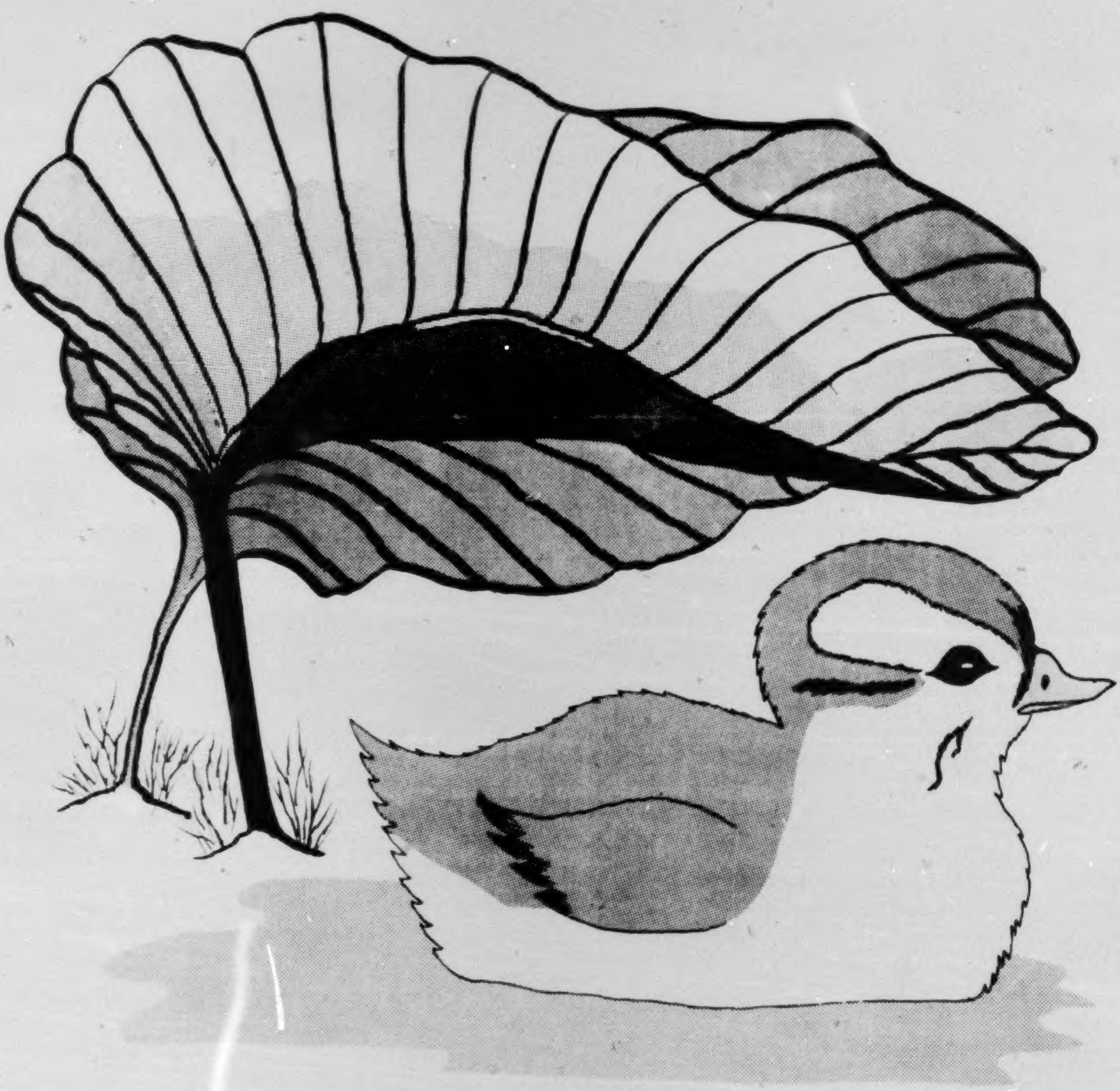
Communicate feelings, awareness, and values by describing in writing the effect of a given object on the environment.

EQUIPMENT NEEDED

30 cross sections of trees
6 increment cores (preferably in plastic) from numbered trees
30 hand lenses (optional)
30 pieces sketching paper
lab sheets
task cards
natural materials for sketching

This lesson plan was developed for use in teacher workshops by:
Martha Neyland Skamania, Washington
Jeannie Williams Salem, Oregon
Charline McDonald Portland, Oregon

The lesson plan was revised in November 1971. It is suggested by the writers that continuous revision take place by people who use the ideas.



Mechanics

LEADING CHILDREN IN THE FIELD

- a few hints -

I. BEFORE THE TRIP

A. Prepare Yourself

1. Define an objective: What are you trying to accomplish?

2. Know the area: Walk the trail. Decide where you want to go. Anticipate things that will contribute to the objective. Look for hazards.

3. Know your activities: What are you going to have the group do? What will you need to take?

4. Review discovery concept: Remember you should help the children discover things for themselves. You don't need to know all the answers yourself.

B. Prepare the Group

1. Create an objective: The group will often become more excited and motivated if they help define the objective.

2. Build up anticipation: Photographs, readings, specimens from the field, trip planning sessions may all help get the class involved.

II. DURING THE TRIP

A. Maintain Order

1. Explain What, Where, When: What are you going to do?
   Where are you going to go?
   How long will you be gone?

2. Define the rules: Should the group walk behind you? or can they go ahead a ways? if so, how far? Where should they go to the bathroom? Are there hazards to stay away from?

3. Keep control of the group: Without restricting freedom, channel the group's activities toward the planned activities. If a deer runs through the group, smoothly take advantage of the excitment, but then get back to the planned activities. Don't tell them what not to do! Tell them what they can do.

B. Safety

1. Walk - Don't Run: unless running is part of the activity

2. Warn the group of hazards in a constructive way: Tell them about rattlesnakes, but emphasize the common sense ways to react if they see one.

3. Watch where their feet go: Tell them to be alert to everything around them.

4. Be prepared for emergencies: Take a first aid kit. Monitor the group and steer them away from potential hazards.

C. Conservation

1. Use good outdoor manners: Explain that the group is visiting the home of living creatures, that they should not be destructive. Point out constructively the impact they have on the environment by just walking on the grass.

2. Practice conservation: Make a point to incorporate some conservative activities and objectives. Collect litter, reclaim a disturbed area, leave the study area better than they found it.

D. Techniques

1. Explain objectives and activities

2. Encourage discovery and questioning

3. Use all senses

4. Move out rapidly to activities. Give the group something to do at all times, but let discussion proceed as long as it's constructive.

5. Take advantage of surprises. Stop to look at interesting and unusual things.

6. Use games, songs, creative dramatics to build interest.

7. Don't allow one individual to dominate the discussions.

8. Keep the field trip to a reasonable length and allow for rest stops. Even children get fatigued.

9. Don't belabor an activity if the group becomes bored, move onto the next activity. Remember that children may be interested in different things than you are. Observe their reactions.

10. Conclude the activities on a high note, a climax.

III. AFTER THE TRIP -- LET THE MEMORY LINGER ON

A. Summarize Things and Events: Don't let the field trip end when you get back to the class room. Encourage discussions about what they saw.

B. Follow-up Activities: Relate the trip to other subjects and build toward other trips. Use first trip as a beginning for in class room activities that can be related to additional field studies. Remember--the field trip should be part of the normal curriculum, a routine activity and not a special event.

206

USE OF AH-NEI

A visit to the Ah-Nei Environmental Education Study Area can be a worthwhile and enjoyable experience for students and teachers alike. Using an outdoor classroom, however, requires skills and preparation not normally associated with teaching. Special care and safety consciousness can result in field trips without frayed nerves, skinned knees and lost children.

Teaching in the outdoors is easy, safe and productive; and can be the most rewarding, exciting part of a child's education.

1. Procedures

Vehicle Travel - Vehicles should remain on the designated road system. Gates should be closed if opened.

Parking - For your convenience, a designated parking area is provided near the entrance to Ah-Nei. This is trailhead for all the Study Areas, and location of the toilets. Encourage everyone to use the toilets before leaving the parking area. All groups will begin and end their stay at this location so help keep the area clean. No garbage disposal is provided so please pack home all refuse.

Trails - Four trails lead to the various study areas. To protect trail side vegetation, visitors should remain on the trails until reaching a study area.

Study Areas - Students are encouraged to explore throughout the study areas, to search out, to examine and to experience all the resources of Ah-Nei. Remember: we are just visitors, the plants and animals must live here. A guest in someone else's home should be courteous.

2. Safety

While Ah-Nei is developed for use as an outdoor classroom, some natural hazards remain. It is important for children and teachers to be aware of dangers such as poisonous snakes, cliffs and steep hills, sink holes, inclement weather, and getting lost. While common sense will prevent most dangerous situations from occurring, knowing what to do in an emergency is vital information.

A. Hazards -

(1) Rattlesnakes can be recognized by their large triangular head, dark crossbars on back near tail and rattles. If alarmed they generate a dry buzzing sound.

Precautions: Look where your feet and hand will be placed. Snakes are hard to see. If you hear the warning "buzz" FREEZE until you have located the snake. Ask another person to use a stick to distract the snake if he is very close to you and in a "strike" position. If someone is bitten by a rattlesnake do not attempt first aid; rush him to the nearest doctor.

(2) Cactus and yucca are plants easily recognized by their sharp spines that may inflict painful wounds. The best preventative is alertness. Before sitting or kneeling check for cactus; watch where you place your hands when climbing. Although painful, cactus and yucca are not poisonous.

(3) Ticks and stinging insects may be encountered at Ah-Nei. Probably the greatest single insect problem at Ah-Nei is the presence of ticks during the first warm spring days. The only precautions are to avoid sitting in deep grass and to inspect the body periodically.

Wasps, bees and mosquitos may occasionally become a problem. Insect repellant will help. It is crucial to know if any students are allergic to insect sting or bites.

(4) Cliffs, steep hills and sink holes offer real possibilities for serious falls. The best precaution is to conduct most activities away from these hazards and to keep control over the group whenever working near a drop off.

(5) Water always is a potential hazard. At Ah-Nei standing water is limited to several ponds in the Natural Cycles Study Area. Children working in this area should always be supervised.

(6) Weather can turn a peaceful outing into an uncomfortable or dangerous situation. Conditions at Ah-Nei vary from sub-zero temperatures in winter to 100°+ in summer. Comfortable spring and fall days may change suddenly to freezing cold. Anticipating weather changes is the best insurance. Appropriate clothing for all possible conditions should be brought.

In winter heavy coats, snowproof boots, gloves and warm hats should be worn.

In summer cool clothing, sturdy boots and light caps are suggested.

Spring and fall conditions vary so greatly and rapidly that provisions for cold, warm and wet conditions should be made. As always sturdy shoes or boots are recommended. Rain gear and warm coats or jackets should be brought "just in case".

(7) Getting lost at Ah-Nei could be a dangerous experience. Prevention is the best precaution. Every child should be taught basic outdoor skills relating to route finding and survival if lost or hurt. Teachers should familiarize themselves and their class with Ah-Nei and maintain some control over the group on outings. Since most work will be done off of trails and away from roads it will be easy for the unprepared to become disoriented.

When lost all the potential hazards become more dangerous. Snake bite, a fall or a storm are much more serious when alone and away from transportation, so:

1. Know the area
2. Be prepared for all kinds of weather
3. Stay with the group (Keep the group under control)
4. Be familiar with basic survival skills, and first aid

3. Outdoor Skills

Orientation is among the most important of skills for survival in the out-of-doors. Map reading, aerial photo interpretation, using the compass to find a good route are all a part of orienting oneself. Included in this notebook is an aerial photo of Ah-Nei that will quickly show the "lay of the land". A topographic map is not yet available for Ah-Nei, but should be completed by the U. S. Geological Survey within the next year. When completed the topographic map will be a basic tool used by students at Ah-Nei.

4. Preservation

One of the educational objectives of Ah-Nei is providing students the opportunity to discover that we can use the environment without destroying it. As a practical demonstration of this concept users of Ah-Nei should follow some simple preservation rules.

A. Walk lightly, kill nothing. Naturally, groups cannot use Ah-Nei without causing some vegetation loss and some loss of wildlife habitat. Our goal should be to minimize resource loss, by using the trails and previously disturbed areas.

B. No fires.

C. Observe wildlife quietly from a distance. The wild animals at Ah-Nei will allow us to watch them if we don't get too close, make a lot of noise or throw rocks. Approaching too close to a bird's nest or touching the eggs may result in abandonment of the nest.

D. Put everything back in its place. If we dig holes in an investigation we should fill them in the same order as we found them; soil in bottom, pine needles on top. Insects may live under rocks, moving or turning over those rocks may destroy a home.

IN REPLY REFER T

March 3, 1849

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Billings District Office
P. O. Box 2020
Billings, Montana 59103

Dear Parents,

The Bureau of Land Management has designated an area of public land for use by the Billings School District as an Environmental Education Study site. Initially, grades K-5 will be involved in the program. The area consists of approximately 4,000 acres, called "Ah-Nei." It is located 24 miles from Billings near Acton, Montana.

The site offers opportunities for exploration of three types of ecosystems. It is representative of local physical environment, thus promoting familiarity and a feeling of responsibility for what is around the user.

Emphasis will be placed on student investigation and personal experience, with the objective being increased understanding of the environment, man's place in it, his responsibility for the future.

It is my hope that local students will be involved in a most pleasurable educational experience at Ah-Nei.

Sincerely,

C. Rex Cleary

C. Rex Cleary
District Manager

STUDENT'S CHECKLIST

_____ 1. Lunch and filled water container.

_____ 2. Rainwear (large garbage bag will suffice)

_____ 3. Hat or scarf.

_____ 4. Coat or jacket suitable for the season.

_____ 5. Pencils.

_____ 6. Heavy boots or shoes suitable for hiking.

_____ 7. Small day pack if you have one.

_____ 8. Gloves if weather requires.

PRINCIPAL'S CHECKLIST

_____ 1. Planning meeting with all involved.

_____ 2. Special teachers participation planned.

_____ 3. Additional participation planned (aids, parents, etc.)

_____ 4. Buses equipped with first aid kit.

_____ 5. Weeks schedules planned.

_____ 6. Principal's letter to parents, including schedule and arrangements.

_____ 7. Student's checklist.

_____ 8. Permission to attend.

TEACHER'S CHECKLIST

_____ 1. Attendance at the workshop.
_____ 2. Special teacher assignments planned.
_____ 3. Daily schedules planned and approved by principal.
_____ 4. Plans for supplies and equipment.
_____ 5. Principal's letter.
_____ 6. Students checklist.
_____ 7. Bureau of Land Management Letter.
_____ 8. Permission slips.
_____ 9. Curriculum guide.
_____ 10. Lunch and filled water container.
_____ 11. Outer wear appropriate for weather and activities.
_____ 12. Small day pack if you have one.

Suggested Planning Schedule for "Ah-Nei"

School Name Day-Date	Grade	Number of Students	Teacher	Aid	Other

SUGGESTED REFERENCES

Berglund, Berndt and Clare E. Bolsby, 1971, *The Edible Wild*: New York, Charles Scribner's Sons.

Committee for Energy Conservation, 1974, *A Teacher's Handbook on Energy*: Denver, Colorado, Colorado Department of Education.

Couchman, J. K., J. C. MacBean, Adam Stecher and Daniel F. Wentworth, 1971, *Mini--Climates* (Examining Your Environment Series): Minneapolis, Minnesota, Mine Publications, Incorporated.

Craighead, John J. and Frank C. Craighead, 1963, *A Field Guide to Rocky Mountain Wild Flowers*: Boston, Houghton Mifflin Company.

EMC, 1973, *Exploring the World*: Billings, Montana, Eastern Montana College and School District 2.

Frazier, Kenneth E., Coordinator, 1972, *Teacher Resource Booklet*; *Project ECO*: Ames, Iowa, Ames Community Schools.

Land Management, Bureau of, U. S. Department of Interior: *All Around You*, An Environmental Study Guide, Washington, D. C.

MacBean, J. C., Adam Steher, D. F. Wentworth, and J. K. Couchman, 1972, *Trees* (Examining your Environment Series): Toronot, Holt, Rinehart and Winston of Canada, Limited.

Pearl, Richard M., 1955, *How to Know The Minerals and Rocks*: New York, McGraw--Hill Book Company.

Pohl, R. W., 1968, How to Know the Grasses: Dubuque, Iowa, Wm. C. Brown Comapny Publishers.

Pough, Frederick H., 1960, A Field Guide to Rocks and Minerals: Boston, Houghton Mifflin Company.

Research Department, 1974, The LaMotte Soil Handbook: Chestertown, Maryland, Lamotte Chemical Products Co.

Ris, Thomas F., editor, 1974, Energy and Man's Environment: Washington State Office of Environmental Programs.

Stecher, Adam, D. F. Wentworth, J. K. Couchman, and J. C. MacBean, 1971, Running Water (Examining Your Environment Series): Minneapolis, Minnesota, Mine Publications, Inc..

Swan, James A. and William B. Stapp, 1974, Environmental Education-Strategies Toward A More Livable Future: New York, Halsted Press Division, John Wiley & Sons.

Swan, Malcolm D., 1970, Tips and Tricks in Outdoor Education: Danville, Illinois, The Interstate Printers and Publishers, Inc.

U.S.F.S., 1974, Environmental Education For Teachers and Resource People: Forest Service, U. S. Department of Agriculture.

Van Matre, Steve, 1972, Acclimatization: Martinsville, Indiana, American Camping Association.

Van Matre, Steve, 1974, Acclimatizing: Martinsville, Indiana, American Camping Association.

SUGGESTED REFERENCES

Wentworth, D. F., J. K. Couchman, J. C. MacBean, and Adam Stecher, 1972, Mapping Small Places (Examining Your Environment Series): Minneapolis, Minnesota, Winston Press.